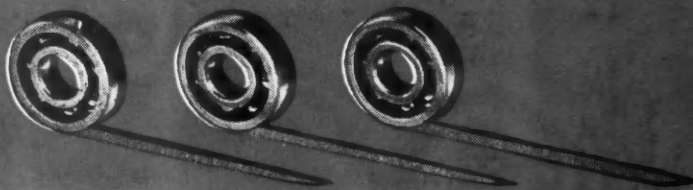


AUTOMOTIVE *and Aviation* INDUSTRIES

MAY 1, 1946

Three little ball bearings



...and how they flew
at 100,000 RPM!

STORY OF THE VT (Variable Time) FUZE...

America's VT or Proximity Fuze is a wonder of the war second only to the atom bomb. In the nose of a projectile, its miniature sending and receiving set sends radio waves ahead. When the target is neared, the waves bounce back and—before the projectile can miss—they explode it!

This "Seeing Eye" feature was 97% effective against V1 buzz-bombs... helped clear the Pacific beaches for invasion... helped turn the tide in the Battle of the Bulge... raked the mainland of Japan... and was deadly against Jap Kamikaze planes.

On land, at sea and in the air, it gave us a super-accuracy of fire that

saved countless American lives and materially shortened the war.

...AND THE VT (Very Tough) BALL BEARINGS THAT HELPED MAKE IT POSSIBLE!

But to make such miracles possible, bearings on the fuze's rotor and impeller shaft must withstand 100,000 revolutions per minute! Could any bearing "take" such speeds and centrifugal force?

New Departure designed ball bearings that could—and did. They stood up... just as rugged New Departure Ball Bearings stand up wherever shafts turn.

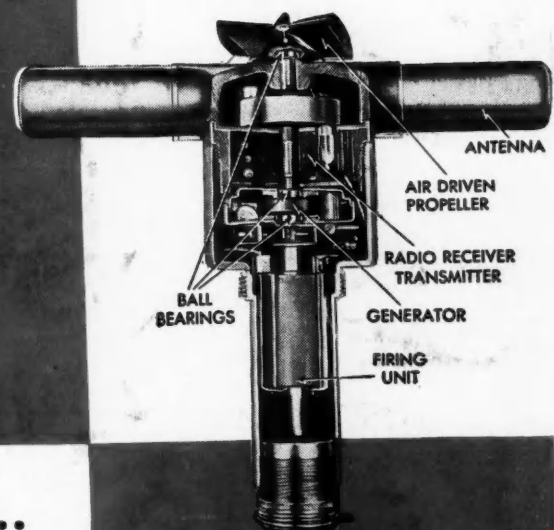
New Departure Ball Bearings are uniquely fit to handle great speeds—as well as heavy loads and requirements of super-rigidity...

...but there is more to a ball bearing than steel and engineering principles. New Departure, world's greatest ball bearing maker, is also famed for solving problems!

3423-R1

Nothing Rolls Like a Ball
NEW DEPARTURE
BALL BEARINGS

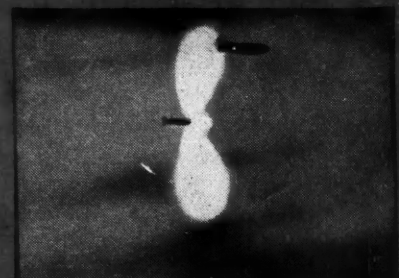
NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN. • Branches in DETROIT • CHICAGO • LOS ANGELES



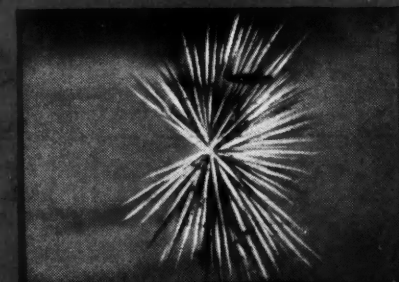
Generator-Powered Bomb Fuze

Sponsored by O.S.R.D. and the U. S. Army with Central Laboratories at the NATIONAL BUREAU OF STANDARDS.

Below: V.T. Fuzed Rocket in action



SENSITIVITY PATTERN



BURST PATTERN

Pictures courtesy of
National Bureau of Standards



It's easy to follow Standard...

Coded Lubrication

It's easy as ABC to install and follow Standard Coded Lubrication. With it, all lubricants are applied by number. There are no brand names or grades for the oiler to remember. There are no records to keep up or other clerical help needed. The four steps at right show just how easy it is.

The results you get with Coded Lubrication are well worth while. It reduces breakdowns resulting from the application of wrong lubricants. It prevents applying costly lubricants where ordinary lubricants can be used. It simplifies training of oilers and crews and eliminates the need for oilers to remember a multitude of brand names.

A Standard Oil Lubrication Engineer will fully explain Coded Lubrication and its application to your plant. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

Here's how easy it is to apply:

STEP 1

Each lubricant used in your plant is assigned a number. These numbers are recorded on a Lubrication Chart—this is the only record making that is ever needed—and copies are kept in the oil room, purchasing department files, or wherever else they may be useful.

STEP 2

The lubricant in each storage container—barrel, drum, dispenser—is identified by the number assigned to it. Numbered decals, in only two color combinations, are used for this purpose—another example of the simplicity of the system.

STEP 3

All points to be lubricated in your plant are also marked with a numbered decal indicating *what* lubricant is to be used and *where* it is needed.

STEP 4

Your oilers fill lubricant dispensers from storage by number and apply lubricants to machines by number.

STANDARD OIL COMPANY (INDIANA)

**STANDARD
SERVICE**

AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

Volume 94

May 1, 1946

Number 9

JULIAN CHASE, Vice-Pres. and Directing Editor
J. R. CUSTER, Associate Editor
R. K. WINKLEBLACK, Ass't Editor
JEROME H. FARRIS, Ass't Editor
MARCUS AINSWORTH, Statistician
L. W. MOFFETT, Washington Editor
E. J. HARDY, Washington News Ed.
JOS. GESCHELIN, Detroit Editor
H. H. ROBERTS, Ass't Editor
LEONARD WESTRATE, News Editor, Detroit
HOWARD KOHLBRENNER, Art Editor
R. RAYMOND KAY, Pacific Coast Editor
KARL RANNELS, SR., Washington News Ed.

CONTENTS

Liberalism and Leadership. <i>By Julian Chase</i>	15
Labor Problems and Purchase Tax Slow Down Britain's Automobile Industry. <i>By John W. Hendry</i> 17	
The 1947 Studebakers	18
Trends and Developments in British Automobiles	22
Aptitude Testing of Ford Workers. <i>By Fred A. Miller</i> 28	
Scintilla's Self-Contained Setup (Part One). <i>By Joseph Geschelin</i>	30
SAE Aeronautic Meeting	34
Application of High Frequency Heating to Silver Brazing and Silver Soldering. <i>By Herman A. Folgner</i>	38
New Production and Plant Equipment	41
German BMW Experimental Car. <i>By W. F. Bradley</i> 44	
Machine Tool Standards. <i>By A. P. O'Neill</i>	47
New Products	49
News of the Industry	54
Calendar of Coming Events	58
Redesigned Body on IHC Trucks	60
Advertisers' Index	164

Copyright 1946 by Chilton Company (Inc.)

Automotive Division
G. C. BUZBY, President and Manager
E. H. MILLER, Adv. Mgr. E. W. HEVNER, Cir. Mgr.

OFFICES

Philadelphia 39, Pa., Chestnut & 56th Sts., Phone Sherwood 1424
New York 17, N. Y., 190 East 42nd St., Phone Murray Hill 5-8600;
Chicago 1, Ill., Room 916, London Guarantee & Accident Building, Phone
Franklin 4243; Detroit 2, Mich., 1015 Stephenson Bldg., Phone Madison
2090; Cleveland 14, Ohio, 1030 Guardian Bldg., Phone Cherry 4188; Wash-
ington 4, D. C., 1061 National Press Bldg., Phone District 8109 and 8110;
San Francisco 5, Calif., 605 Market St., Room 608, Phone Sutter 4951;
Los Angeles 1, Calif., 6000 Miramonte Blvd., Phone Lafayette 5525.

Cable Address Autoland, Philadelphia

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile
(monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman
(monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and
the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
❶ CHILTON COMPANY (INC.) ❶

Executive Offices

Chestnut and 56th Streets, Philadelphia 39, Pa., U. S. A.

Officers and Directors

JOS. S. HILDRETH, President

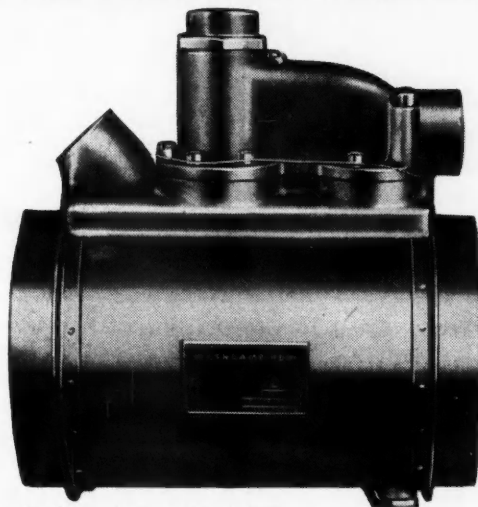
Vice-Presidents

EVERIT B. TERHUNE J. H. VAN DEVENTER C. S. BAUR
P. M. FAHRENDORF JULIAN CHASE
WILLIAM A. BARBER, Treasurer JOHN BLAIR MOFFETT, Secretary
THOMAS L. KANE G. C. BUZBY HARRY V. DUFFY
CHARLES J. HEALE

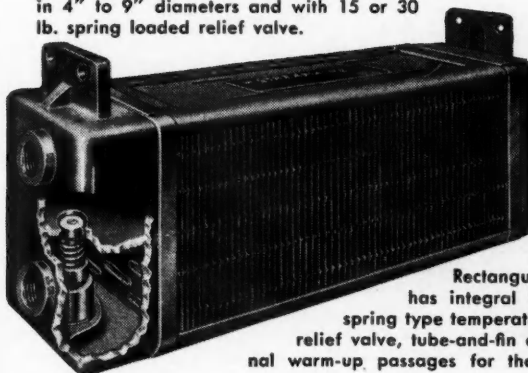
WILLIAM H. VALLAR, Asst. Treas.

PAUL WOOTON, Washington Member of the Editorial Board

YOUNG Presents Two New OIL TEMPERATURE REGULATORS



"Streamaire" Regulator (above) is a new jackless, light-weight type. Internal oil passages provide anti-congealing, warm-up performance. Equipped with thermostatic control and relief valve. Available in 4" to 9" diameters and with 15 or 30 lb. spring loaded relief valve.



Rectangular type (above) has integral thermostatic or spring type temperature control and relief valve, tube-and-fin core with internal warm-up passages for thaw-out.

● Keeping pace with the demands of the constantly changing picture in aviation, Young Engineers have established a reputation as a source for specially designed aeronautical heat transfer equipment. Typical are the two new, exceptionally efficient, low-cost oil temperature regulators, above. Mite-size, but mighty able, they are designed and engineered for specialized application. Here again, care in planning and procedure pays off in maximum efficiency . . . performance plus . . . longer life. Refer your cooling problems to Young Engineers today.

YOUNG



HEAT TRANSFER PRODUCTS

Oil Coolers • Gas, Gasoline, Diesel Engine Cooling Radiators • Heat Exchangers • Intercoolers • Engine Jacket Water Coolers • Unit Heaters • Convectors • Condensers • Evaporators • Air Conditioning Units • Heating Coils • Cooling Coils • and a Complete Line of Aircraft Heat Transfer Equipment.

YOUNG RADIATOR COMPANY, Dept. 216-E, RACINE, WIS., U. S. A.

May 1, 1946

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

3

AUTOMOTIVE and AVIATION INDUSTRIES. Vol. 94, No. 9. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries. \$1.00 per year. Canadian and Foreign \$2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), 50 cents.

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

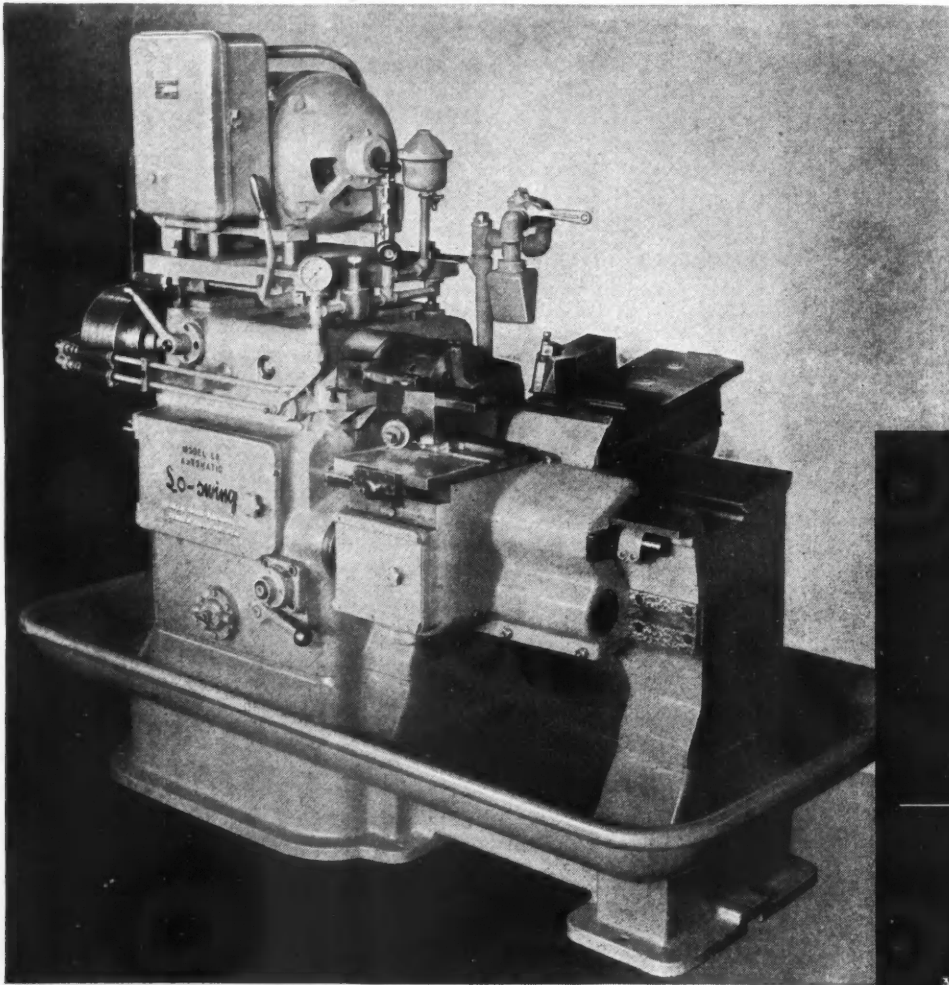
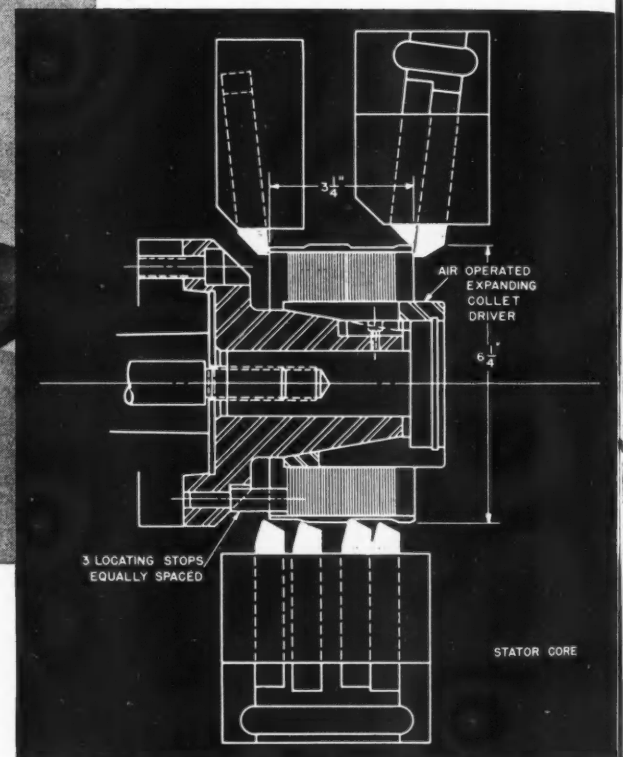


Illustration at left shows a Model "LR" Lo-swing Lathe equipped for chuck work. This same lathe, tooled as shown in the line drawing below, is used for turning and facing Stator Cores described in this advertisement.



MODEL "LR" AUTOMATIC Lo-swing LATHE SAVES TIME ON CHUCK WORK

PROBLEM: To automatically turn, face and chamfer Stator Cores for electric motors. Operation must be fast and accurate.

SOLUTION: The Model "LR" Automatic Lo-swing Lathe selected for this job was equipped with a special air-operated, expanding collet chuck which assures close concentricity between the bore and the outside diameter of the Stator Core. The piece is positioned on the expanding

collet by means of three equally spaced locating stops, shown on the line drawing. The collet is expanded by means of a pull bar operated by an air cylinder mounted on the spindle. The outside diameters are turned with four tools mounted on the front slide and the squaring and chamfering is accomplished with three tools mounted on the rear slide.

The Model "LR" Lo-swing Lathe is completely automatic and may be operated by unskilled operators, who merely load and unload the parts and push the starting lever.

Seneca Falls Machine Co., Seneca Falls, N. Y.

LATHE NEWS from SENECA FALLS

Liberalism and Leadership

By Julian Chase

"THE core of the liberal creed," says William A. Orton in his book, *The Liberal Tradition*, "is that in a true community the members are truly free." The essence of liberalism, according to one interpretation of the author's meaning, is "an ever-expanding individual liberty in an ever-widening community."

If this is accepted as a basis for a true definition of a much abused term, how are we to designate more precisely many of those who today call themselves liberals? What is presently termed liberalism is, to a rather general extent, no more than a plume for a politician's hat. Only a few of those who blatantly flaunt such an illy appropriated decoration are true liberals. They are, instead, to be classed not even with the conservatives whom they are wont to disparage, but with the reactionaries whom they pretend to hate. They prate about liberalism and, with the same breath, propose measures that would, in their ultimate effect, lead us directly away from the kind of community in which the members are truly free.

Professor Orton points out that a type of social control which relies "more and more on a simple aggregation of supposedly similar individuals could not possibly express much more than the appetites and impulses individuals actually have in common, *at the level at which they are common*" (our italics) and he adds that more importance attaches "to the size of the aggregate than to the quality of the collective intention."

More and more, of late, has our national government been called upon to solve the problems and to take on the burdens of the individual citizens and the several states. More and more has the "voice of the people," coming largely as an echo from the shoutings of self-styled "liberal" politicians, demanded national action on matters that rightfully and healthfully should be cared for in other ways. Our erstwhile and present leaders are the ones at fault. Our country is run on the principle of equalitarian majority rule. It is a sound principle. But the masses are prone to think pretty generally as the most artfully vociferous politicians would have them think.

With respect to the relatively little things of life it is well known, even at low levels of intelligence, that the most loftily inspired idiot can be as dangerous and destructive as the most brilliantly minded scamp, and we guard against both. But it is not so with respect to the larger aspects of our life, our social and economic wellbeing, the sanctity and freedom of the individual. Too many of us, seduced by the rainbow promises of the ambitious agitator or the shallow but sometimes well-meaning politician, neglect or are unable to give due thought to either the possibility or the protracted consequences of fulfillment.

What democracy needs most is informed and intellectually honest leadership. It needs leadership that has the ability, the will and the determination to think things through, to see clearly and far in advance what follows action as a logical eventuality. It needs leadership that is not only wise but courageous to the point of self-sacrifice. It is damaged, and sometimes irreparably, by unwittingly ignorant or self-serving leadership. It needs understanding leadership that is truly liberal on a fully comprehensive scale.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

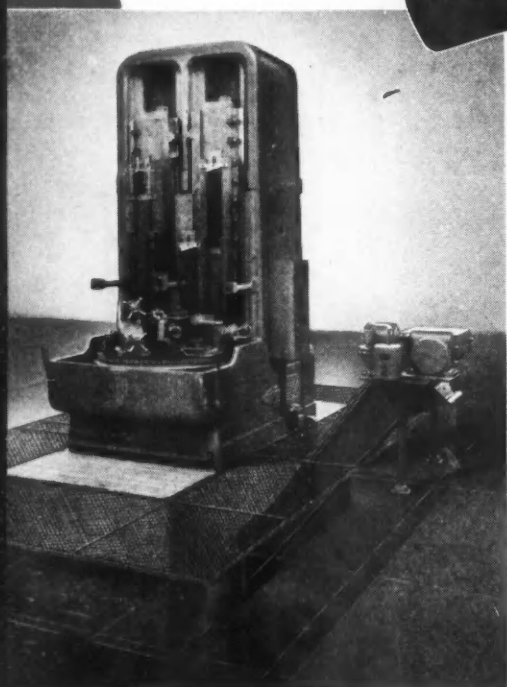
May 1, 1946

15

NO MORE MINING OF CHIPS...
*they come out automatically
 with this equipment!*



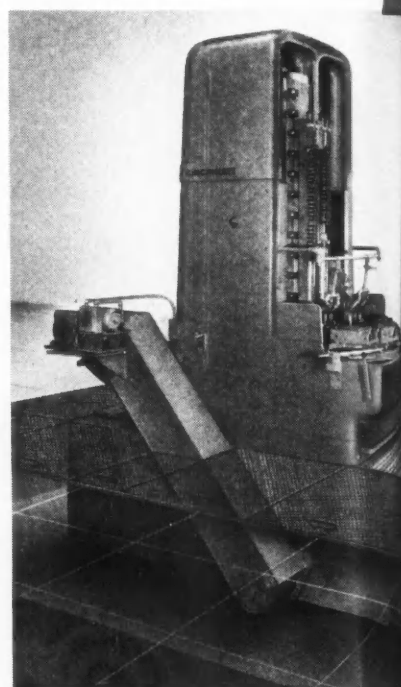
CINCINNATI Chip Conveyor designed for use with CINCINNATI Vertical Hydro-Broach Machines.



CINCINNATI Chip Conveyor arranged to deliver the chips to side of the broaching machine.

It's not a pleasant job—nor particularly easy—to remove the grill work or metal covers around pit mounted vertical broaching machines, climb down into the pit and scrape the chips out of the machine and into a pan. It's like a one-man mining project, with no machinery. The CINCINNATI Automatic Chip Conveyor, designed for CINCINNATI Vertical Hydro-Broach Machines, eliminates this frequent and laborious job. Individually motor driven, it operates continuously or intermittently, as desired, conveying the chips from the chip compartment and up to a waiting push cart or receptacle on a lift-truck platform. The illustration above shows clearly the operating principle—feed screw and buckets on an endless chain.

Equipment of this type pays off in two ways, in eliminating a needless labor cost and in reducing distractions for the machine operator. Specify the Automatic Chip Conveyor for your next CINCINNATI 3, 5 or 10 ton Vertical Hydro-Broach Machine. Meanwhile we shall be glad to tell you more about this equipment.



CINCINNATI Chip Conveyor arranged to deliver chips to the rear of the broaching machine.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES

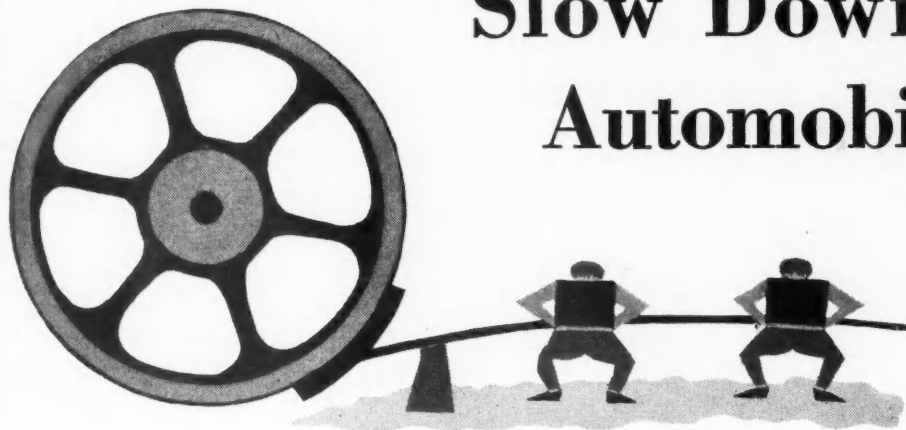
•

BROACHING MACHINES

•

CUTTER SHARPENING MACHINES

Labor Problems and Purchase Tax Slow Down Britain's Automobile Industry



*Aircraft
Firms Make
Good Progress*

LIKE the rest of the industrial countries, Britain's economic recovery is subject to the outlook by labor and for the time being it must be admitted that recovery is being delayed by industrial discord. In order to get a clear picture, it is necessary to compare wages and expenditure with those of the prewar era. In 1937, the average working week was 47½ hours and income for that was averaging 69 shillings. In the automobile and aircraft industries, it was rated higher, being 78 shillings. Today the working week is back to 47½ hours, wages in the engineering works average 84 shillings. But the cost of living is indexed at 47 per cent above that of 1939, so that it outbalances the eight per cent wage rise.

During the war this was not so noticeable for the worker had to work a minimum of 54 hours and the majority worked 60. Since these extra hours were at one and a half or double time, the take-home wages were always higher than the cost of living, so that marginal income was greater than in 1939. Additionally, he had more meals at work (cheaper) and also enjoyed relatively high bonuses due to "sympathetic" relaxing of piece-work rates.

Now rates are being tightened up in order to get more output at economic prices. A recent wages award consolidated his cost of living bonus in the flat rate and hours are shorter, so that for net pay he finds he has to produce more for less money . . . which, under the Socialistic state seems all wrong! Hence the strikes, sponsored not by the unions but by the cell shop stewards; Ford, Humber and A. V. Roe

strikes being symptoms of this unrest. The strike at Avro last year was for a 100 per cent increase in flat rate without measured output. The fact that it failed does not alter the general approach to this problem.

Costs are higher in the automotive and aircraft industries, not so much because of labor charges which account only for eight per cent, but because of low manhour output. Hence the recent appeal by Prime Minister Atlee and the campaign at present in full swing. So against 1939, unit cost is higher in terms of labor, plus also the effect of the purchase tax on accessories and components. In addition, the cost-recovery factor has to be accelerated owing to the restricted home sales, consequent upon the purchase tax,

making it impossible to shift the current models fast enough. Because overhead such as plant, research, design and testing has to be spread over a smaller number, the overhead cost per unit is disproportionately high.

The Society of Motor Manufacturers and Traders has been crusading via press and poster to remove the purchase tax. They style it: "Take the brake off the motor industry." This is doomed to failure. The socialists dare not take off a luxury tax and leave the tax on consumer goods, which would be a negation of their tenets. Apart from the not inconsiderable revenue entailed, there is also the austerity campaign originated by Sir Stafford Cripps. Again, the arguments by the trade that home consumption lowers costs, while not being specious, are offset by the fact that there is a six-month lag between order and receipt of passenger
(Turn to page 60, please)

By John W. Hendry

Special Correspondent of AUTOMOTIVE AND AVIATION
INDUSTRIES in Great Britain



Champion four-door sedan.

Rear view of Champion five-passenger coupe.



NEW styling and redesigned chassis incorporating many mechanical changes to improve riding comfort, performance, and safety make the 1947 Studebakers a distinct departure from their predecessors. Studebaker is the first of the old line companies to announce 1947 models and as described by Paul Hoffman, president of the company, "These cars have been newly engineered from the road up." Body and fender styling is the creation of Raymond Loewy and as a result passenger compartments have been made larger. Mechanical improvements include a redesigned front suspension system, a box section frame, redistribution of weight, a two-section propeller shaft, self-adjusting and self-centering brake shoes, and engines equipped with removable connecting rod bearings and accessories relocated for compactness and convenience.

The 1947 series has been announced in two models—the Champion and the Commander. The Champion is mounted on a 112-in. wheelbase, two in. longer than formerly, and has an over-all length of 192 in. It will be available in two sedans, two closed coupes, a station wagon and a convertible coupe with an automatic self-raising top. Over-all measurements show a maximum height of 60¾ in. (loaded) and a maximum width of 69¾ in. Seat hip room in the four-door sedan is increased to 60 in. in the front and 58 in. in the rear. The front door has four more inches over a previous model, with a new width of 39 in.

Commanders will be available on two wheelbases—sedans, coupes, station wagons and convertible models on a 119-in. wheelbase, and a four-door Land Cruiser on a 123-in. wheelbase.

Both Champions and Commanders are offered in two series—Deluxe and Regal Deluxe. The first series, from the standpoint of appointments and trim, is fully up to the standards set by deluxe models of former

The 1947

years. The Regal Deluxe series has even greater style and luxury treatment.

In redistributing the weight, the L-head, six-cylinder Champion engine has been moved six in. farther forward over the front suspension. It develops 80 hp at 4000 rpm. Specifications list a bore and stroke of 3 in. by 4 in. and displacement of 170 cu in. The compression ratio is 6.5 to 1, with an optional ratio of 7 to 1.

Commander engines develop 94 hp at 3600 rpm. These powerplants are also of L-head, six-cylinder design with bore and stroke of 3 5/16 in. by 4 3/8 in. and displacement of 226 cu in. Compression ratio is 6.5 to 1 with an optional ratio of 7 to 1.

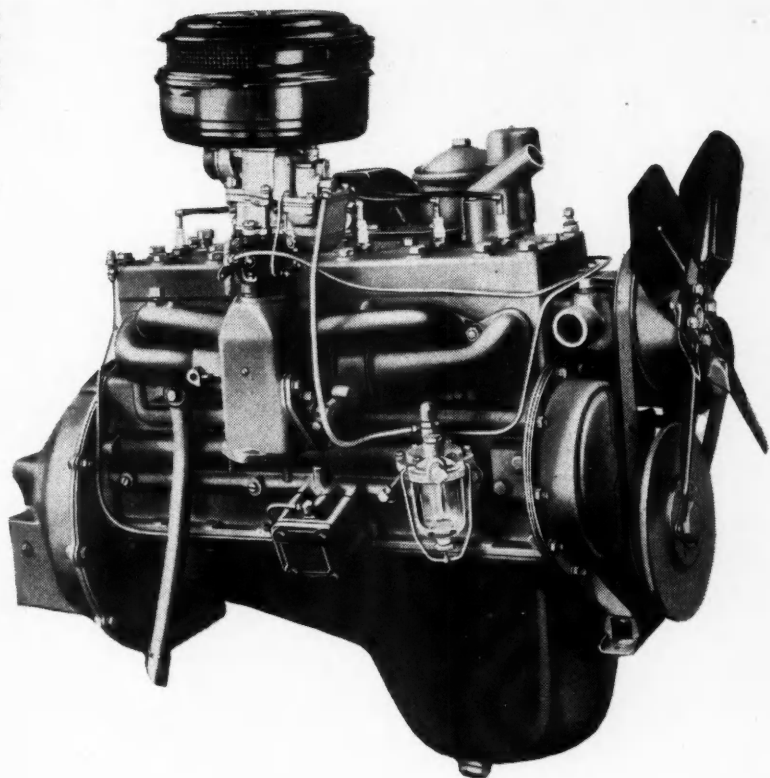
Aluminum alloy pistons, automatic spark control, automatic heat control and automatic choke are continued. New removable steel-backed bearings for connecting rods follow the practice Studebaker applied to main bearings for many years. There is a larger battery with 100 ampere hour capacity for increased demands of electricity. Batteries and oil filler-pipes have been relocated for greater convenience. Oil pump capacity has been boosted to assure an added

Relocation of the oil filler pipe to the front of the engine, removal of the starter motor to the battery side, mounting of the timer pointer on the vibration damper, a single mount at the front and a two-point mounting at the rear, and a new oil pan are the major changes in the Studebaker 1947 engine.

margin of safety. A solenoid switch has been added to the starter mechanism to give smoother engagement and consequent longer ring gear life.

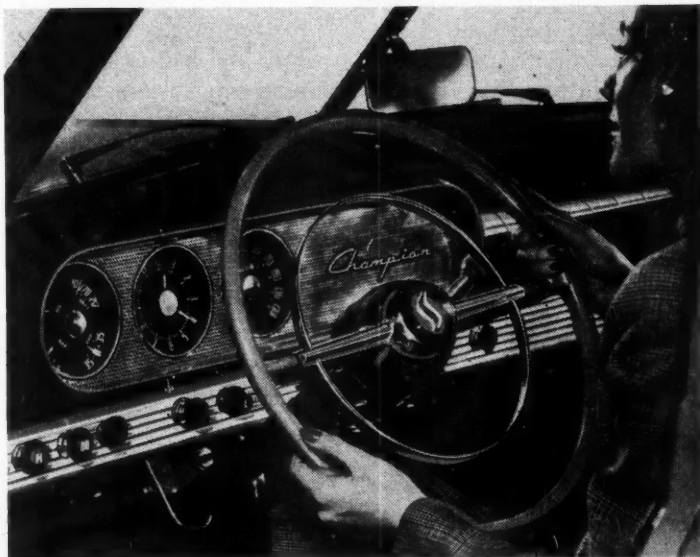
Two advantages are manifest from the two-section propeller shaft design. The two sections meet at an angle in a rubber-mounted amidship bearing, which is supported in the cross member at the center of the frame, obviating the need of a floor tunnel in the rear compartment. In operation, the "whip" commonly associated with elongated propeller shafts has been avoided. All universal joints are equipped with grease fittings.

The new Champion transmission has heavier gears. Hypoid rear axles are continued on all cars. Standard rear axle gear ratio on the Champion is 4.10 to 1 with 4.56 to 1 for cars equipped

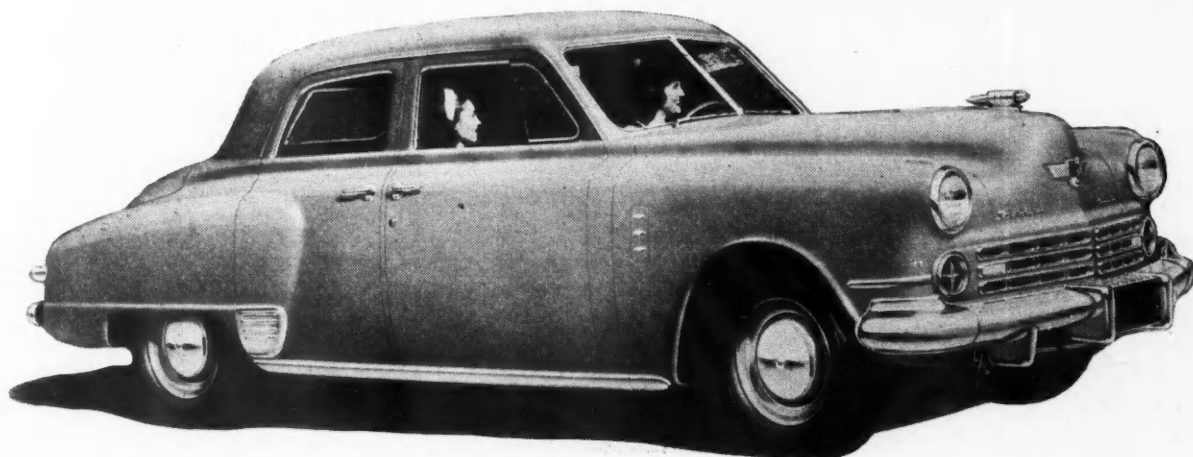


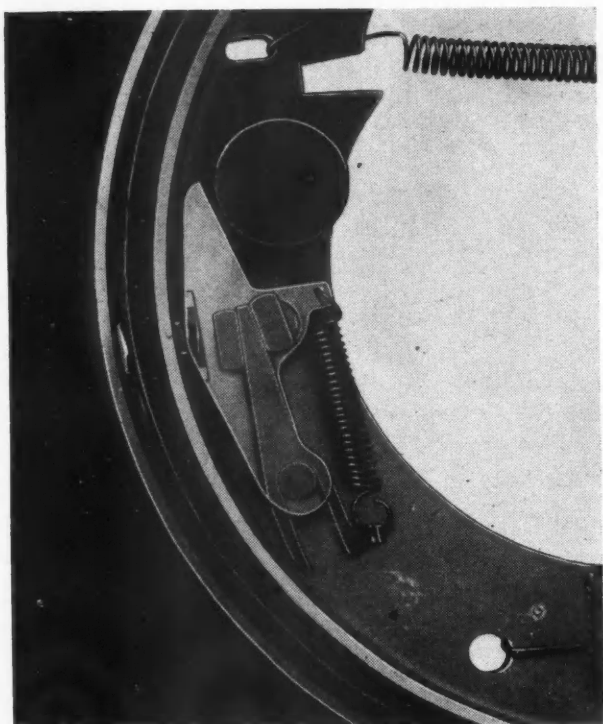
Studebakers

Studebaker instrument group—illuminated at night by "black light."



Commander four-door sedan.





Brake shoe self adjusting mechanism.

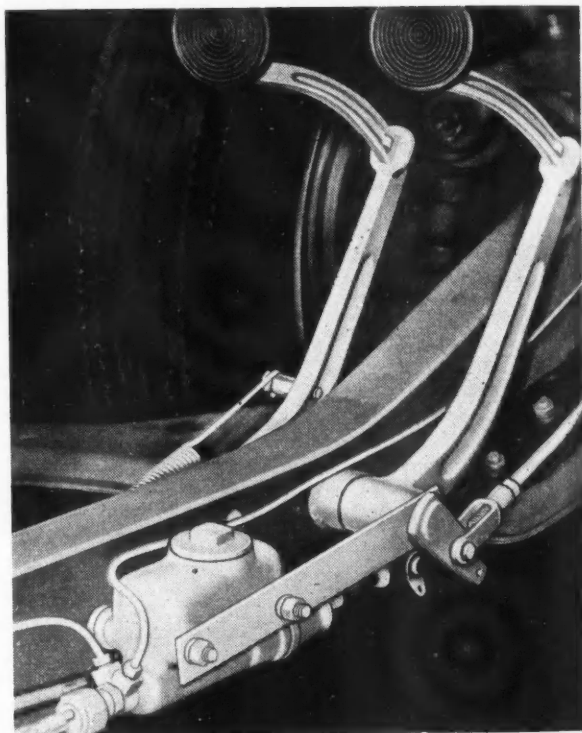
well as cross-members are box sections and are double flanged at the bottom for greater strength. New body mountings are both outrigger and direct. The number of "lock points" between body and frame has been increased.

The planar type front suspension has been re-engineered, with softer, more efficient springs and a revised front mounting that enhances riding comfort. In the preceding design, the spring served in some degree as a structural member. The ends of the laterally mounted springs were anchored to shackle pins. With the new type, spring ends "float" on rubber cushions. The weight of the body and engine receives the full benefit of spring flexibility. New lower

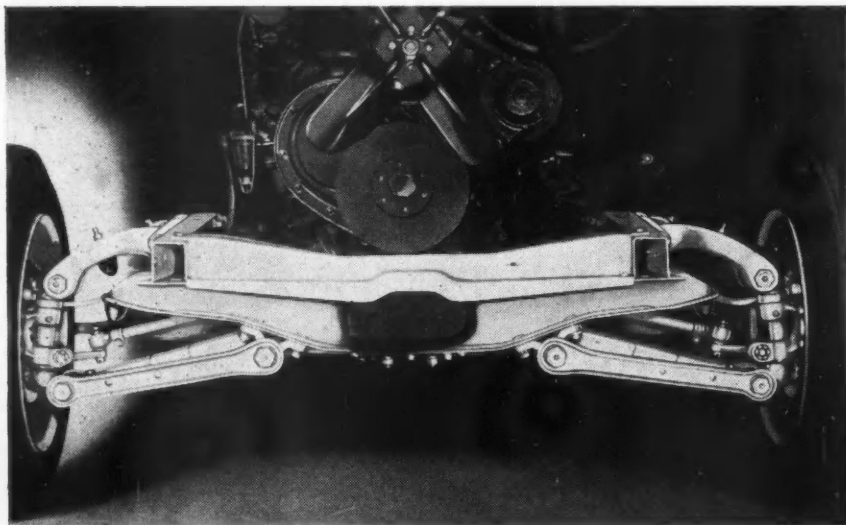
with overdrive and a final ratio of 3.29 to 1 in overdrive. On the Commander it is 4.09 to 1 and 4.55 to 1 with a final ratio of 3.18 to 1 in overdrive.

Studebaker retains the needle roller and ball thrust bearings in steering knuckles, with an improved position for needle roller bearing mountings. Variable ratio steering and symmetrical direct-action steering linkage remain. Hill-holders, oil cleaners and vacuum booster for windshield wipers are standard equipment on all Commanders, and are available as optional equipment on the Champions.

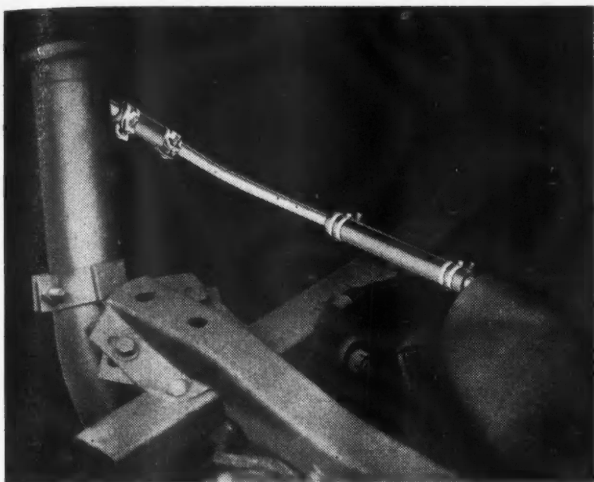
The box-section frame provides extreme rigidity, especially in a longitudinal direction, and its shape is new. Kick-ups over both the front and rear axles make possible a low, flat mid-section. Side rails as



Mounting of the brake pedal, master cylinder and clutch pedal on the box section side rail.



The redesigned front suspension system and front cross member of the 1947 Studebakers. Continuing the planar suspension design, lower control arms have been added between the bottom of the steering knuckles and the frame. Ends of the transverse spring rest on rubber mounts.



Air relief pipe between fuel tank and filler pipe.

new tires have seven ribs, whereas former models had six-ribbed tires.

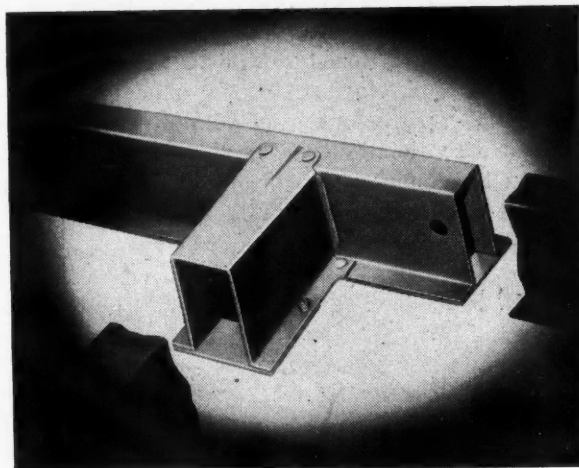
Optional equipment on all cars include the overdrive and the Studebaker Climatizer, an underseat heater.

Improvements in riding characteristics are due to a combination of advances—redistribution of weight, redesigned frames, revised spring mountings, and softer springs. As part of the redistribution of weight, in addition to moving the engine forward, the pas-

support arms take the entire load of road shocks and all of the "twist" of brake application. Flexoliners are again present in all springs.

Self-adjusting, self-centering brake shoes are another contribution. An automatic control, built into the brake assembly, keeps friction forces and their application constant in service. The action is due to two new and related mechanisms. The mounting of the shoe is on an eccentric in the center, instead of being held rigidly by a fixed anchor pin at the bottom of the backing plate. A wedge-shaped arm presses against the eccentric as a graphite bronze contact plug, placed in the surface of the lining area on the front shoe, maintains contact with the brake drum. The contact device controls a spring mounting which moves the shoe outward in steps of 0.005 in. The new mechanism not only takes care of brake shoe adjustments automatically, but the constantly corrected clearance enhances safety. As an aid to greater driving security braking areas have been increased.

Studebaker's broader wheel rims are equipped with 5.50-15 tire sizes (6.50-15 on the Commanders). The



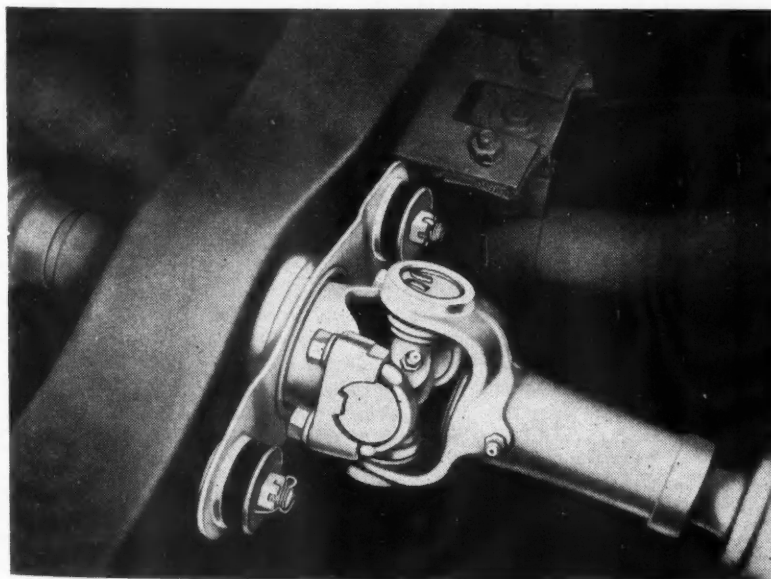
Construction of the box section side member and cross member at mid-frame.

senger compartment has been moved 11 in. farther forward to a position $19\frac{1}{2}$ in. ahead of the rear axle. The center of engine weight is now virtually over the front spring suspension. Center of gravity is lower, resulting from a dropping of the mid-section of the frame.

The body design was wind-tunnel tested at the University of Michigan aeronautical laboratory, and in addition to the usual body types the line includes an entirely new treatment of the five-passenger coupe and also the convertibles and station wagons. Advanced styling and design of the new cars also includes the interiors.

An increase in visibility is apparent in all body types. It is especially in the five-passenger coupes. In this body type the windshield and rear window offer double the glass area of the earlier

• (Turn to page 62, please)



Amidship bearing and universal joint of two-section propeller shaft.

B RITISH cars for 1946, with few exceptions, are very much similar to their respective models built in 1939, the last year of normal civilian production before the war. The Gregoire, a French-designed lightweight car described in the Jan. 15 issue of *AUTOMOTIVE AND AVIATION INDUSTRIES*, is a completely new make on the British market. The Healey and Armstrong-Siddeley cars also are new designs, the mechanical features of the latter make having been reviewed in the April 1 issue of *AUTOMOTIVE and AVIATION INDUSTRIES*.

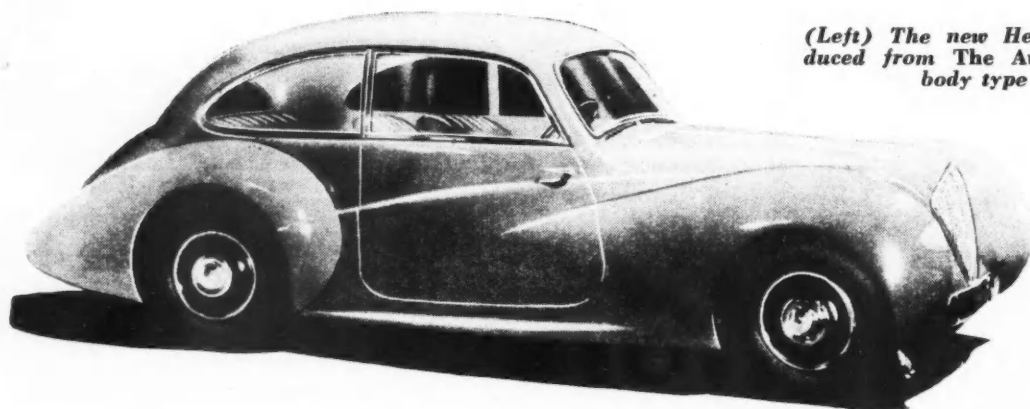
New Healey Car

The new Healey car has a four-cylinder engine of 149 cu in. displacement developing 102 hp at 4500 rpm. Designed and produced by Riley, Ltd., at Coventry, the engine is a development of the model introduced in 1937 with a power output of 83 bhp. The 1946 engine has an exceptionally high specific output of 0.685 bhp per cu in. displacement. Its construction follows the normal practice of the builder in having two cam-

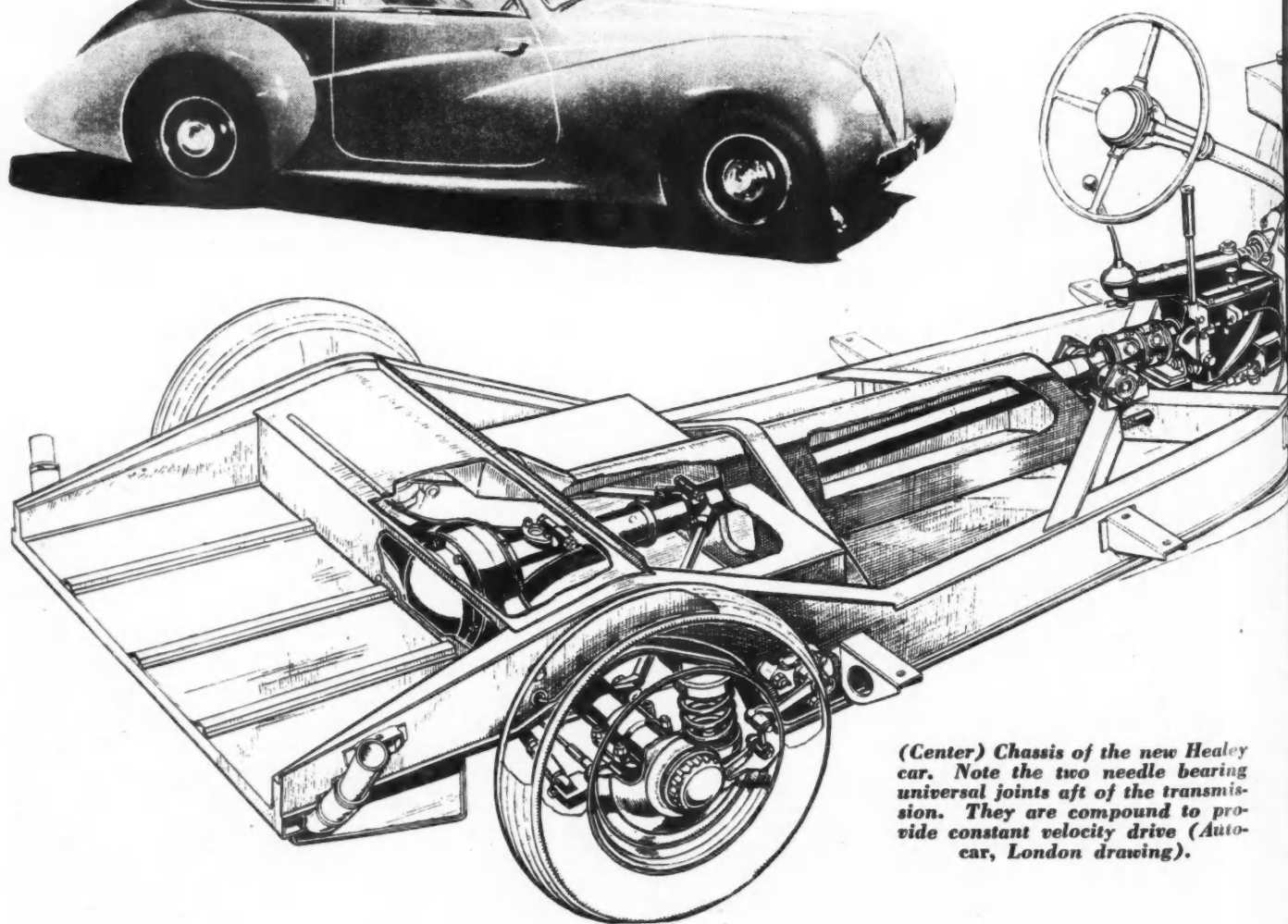
Trends and

shafts, one on each side of the crankshaft. The overhead valves are inclined at 45 deg and the inlet and exhaust manifolds are on opposite side of the cylinder block, two updraft carburetors being bolted directly to the inlet manifold. The cooling system is the closed type with the steam valve set at two atm abs, which permits reduction of the radiator core area to approximately 74 per cent of normal size.

The Healey chassis has a 102 in. wheelbase. The frontal area of the sedan is less than 20 sq ft and according to *The Motor*, it represents the first British car offered to the public that has had its wind resistance studied carefully. As will be seen from the illustrations, the design is much "cleaner" than orthodox British cars. The front fenders are blended into the body side panels which is in step with American styling trends. The headlights have been submerged



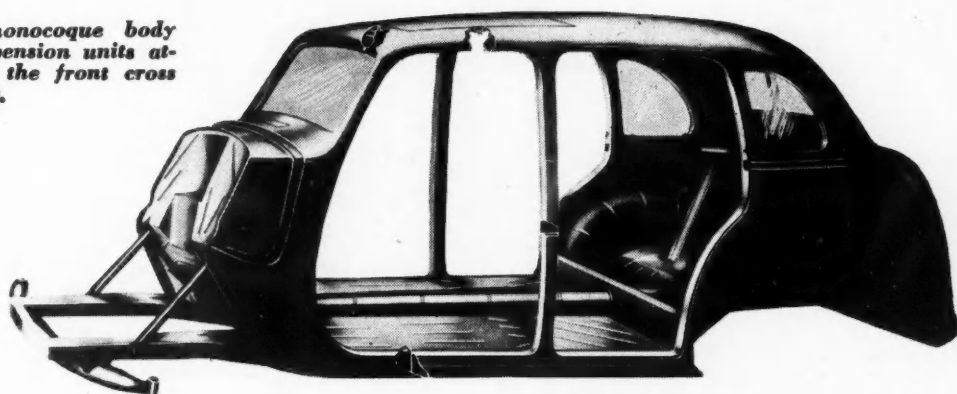
(Left) The new Healey two-door sedan, reproduced from *The Autocar* (London). An open body type also will be built.



(Center) Chassis of the new Healey car. Note the two needle bearing universal joints aft of the transmission. They are compound to provide constant velocity drive (*Autocar*, London drawing).

Developments in British Automobiles

1946 Vauxhall monocoque body has the front suspension units attached directly to the front cross bar.



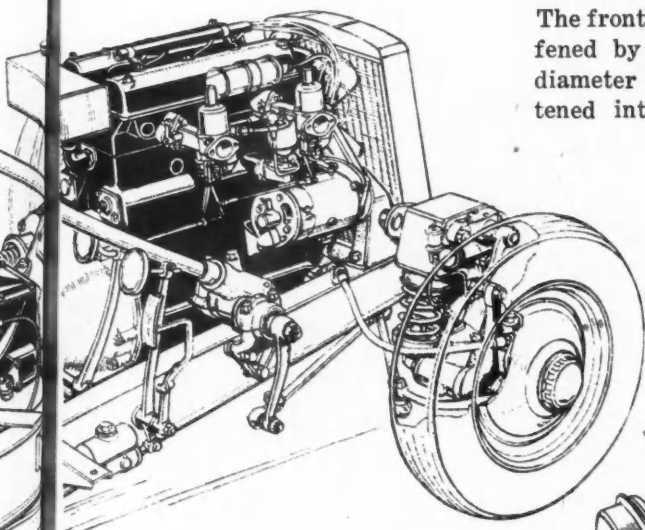
into the fender structure and are covered with an electrically-operated flap.

The body, the weight of which has been held low, is a structure with a wood frame and panels of aluminum alloy sheet (20 gage) containing three per cent magnesium. Fenders are 18 gage steel. The chassis frame weighs 160 lb, is of six in. depth throughout and fabricated from 18 gage steel. Side rails are of box section construction. The front end is stiffened by two large diameter tubes fastened into the box

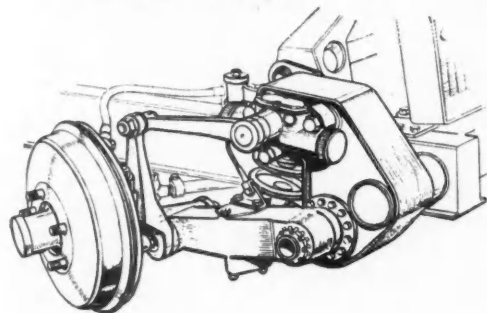
section housing which holds the suspension units.

The front suspension, which is of the independent coil spring type, is of unusual design. The spring is attached mid-way along the bottom arm, thus giving a 2 to 1 lever effect. It is four in. in diameter and is made of 0.5 in. wire. The theoretical stress is 140,000 psi and the rate is 150 lb per in.

The rear suspension also has coil springs of four in. diameter with 0.435 in. wire, shot blasted and enameled. The spring rate is 200 lb per in. and the maximum design stress is 150,000 psi, which is a theoretical figure since rubber buffers take up the load on the limits of travel. Luvax-Girling hydraulic dampers are used both front and rear as shown in the accompanying illustrations. (Next page, please)



(Below) Healey front wheel suspension lower link is made of light alloy mounted on needle rollers with ball thrust bearing (Autocar, London, drawing).



(Above) Healey car rear coil spring suspension (Autocar, London, drawing).

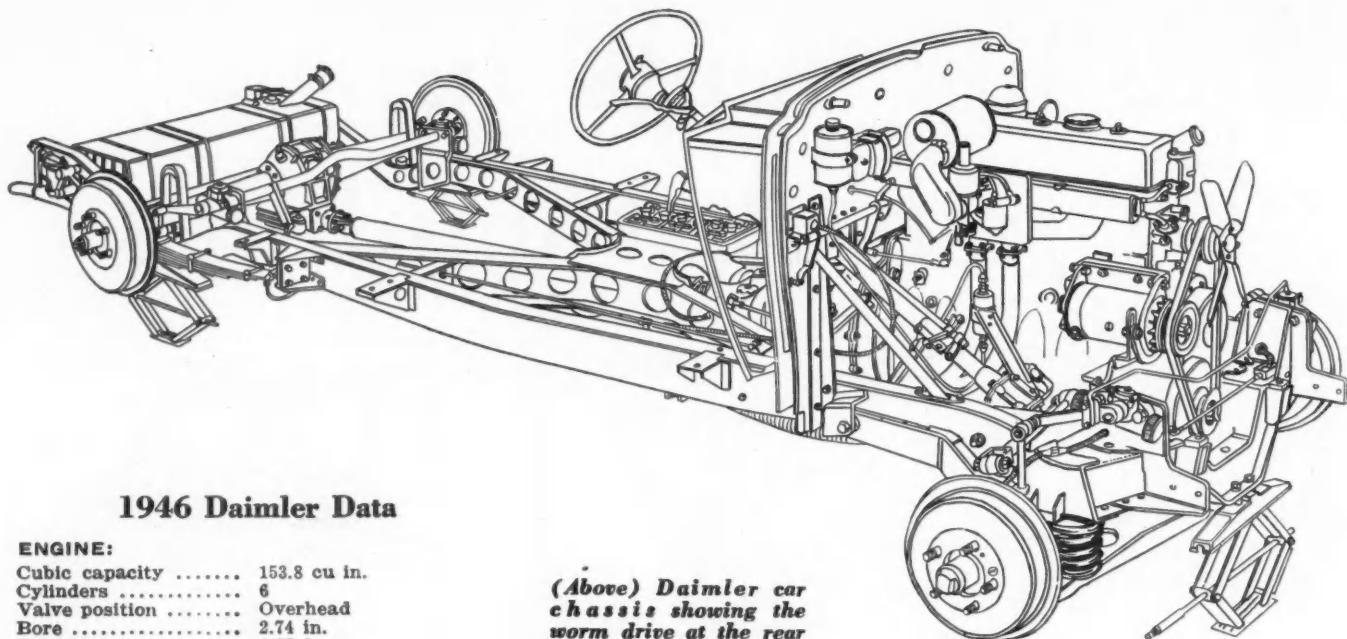
Healey Sedan Data

ENGINE:

Cubic capacity	149 cu in.
Cylinders	4
Valve position	Overhead
Bore	3.17 in.
Stroke	4.72 in.
Comp. ratio	6.5 to 1
Max. power	102 bhp at 4500 rpm
Max. torque	132 lb/ft at 3000 rpm
Piston speed at max. hp.	3550 fpm

CHASSIS:

Wheelbase	102 in.
Tread, front	54 in.
Tread, rear	53 in.
Overall length	169 in.
Overall width	65½ in.
Overall height	58 in.
Ground clearance	7 in.
Turning circle	35 ft
Weight—dry	2350 lb
Tire size	5.75-15
Brakes	Lockheed, hydraulic
Drums, dia.	11 in. front; 10 in. rear
Friction lining area	150 sq in.
Suspension	Front: Independent "trailing link" type, with coil springs
	Rear: Coil springs



1946 Daimler Data

ENGINE:

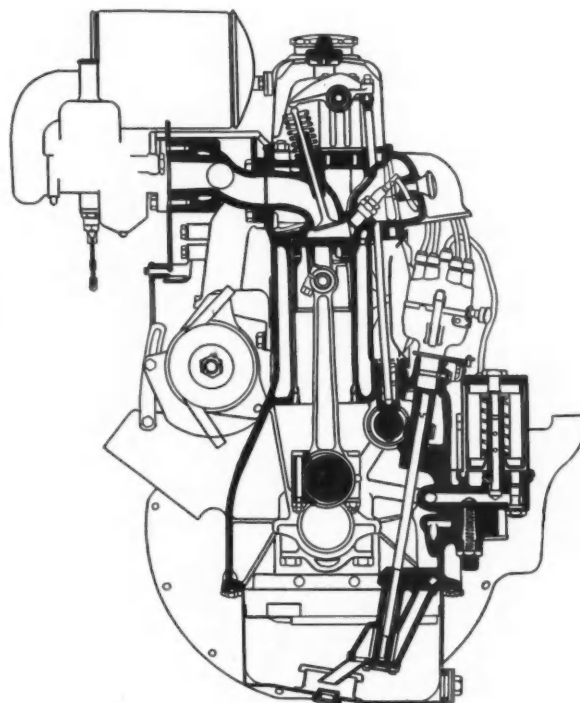
Cubic capacity	153.8 cu in.
Cylinders	6
Valve position	Overhead
Bore	2.74 in.
Stroke	4.35 in.
Comp. ratio	7 to 1
Max. power (A)	70 bhp at 4200 rpm
Max. torque (A)	109 lb-ft at 2000 rpm
Piston speed at max. hp (A)	3060 fpm

CHASSIS:

Wheelbase	114 in.
Tread, front and rear	52 in.
Overall length	15 ft
Overall width	64½ in.
Overall height	63 in.
Ground clearance	6 in.
Turning circle	41 ft
Weight—dry	3470 lb
Tire size	6.00-16
Brakes	Girling mechanical
Drums, dia.	11 in.
Friction lining area	120 sq in.
Suspension	Independent front with coil springs Rear: Half elliptic Luvax piston-type shock absorbers

(A) With normal setting of carburetor, etc.

(Above) Daimler car chassis showing the worm drive at the rear and the permanently attached jacks.



(Right) Vertical sectional view showing the redesigned Daimler engine cylinder-head.

A semi-centrifugal clutch, the latest Borg & Beck development, combining the principles of the entirely automatic clutch which engages by the increase of engine speed from idle and the conventional spring engagement, is employed. It is controlled by a pedal in the usual way, but requires less pedal pressure.

Improved Daimler Car

The Daimler engine has a redesigned cylinder head, in which the pushrod-operated valves are now set at an angle of 15 deg. The shape of the combustion space and ports has been considerably modified, as will be seen in the sectioned view of the engine. This improvement has permitted raising compression ratio from 5.5:1 to 7:1, and has resulted in a power increase from 64 bhp at 4000 rpm to 70 bhp at 4200 rpm. The makers claim that gasoline consumption (Imperial gallons) has been improved to over 22 mpg compared to the previous average figure of 18 mpg.

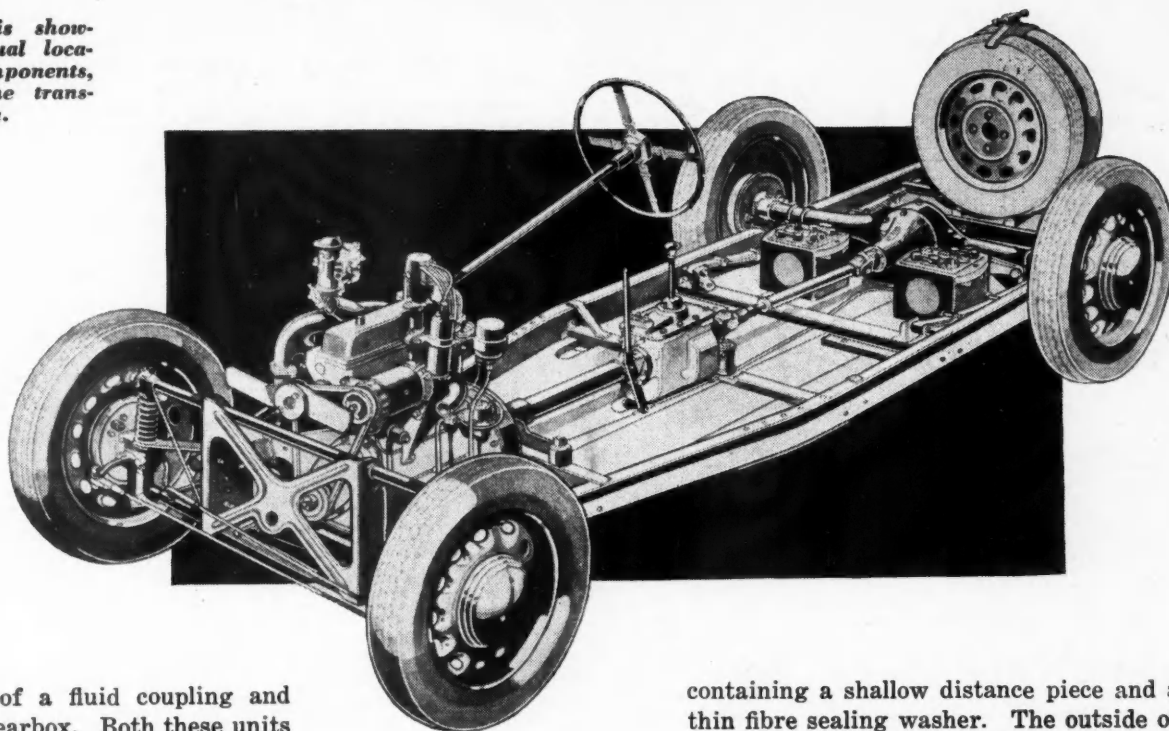
Another feature is the redesigned inlet manifold which is now surrounded for its entire length by an integral cast water jacket connected to the main cooling system by a by-pass from the thermostat. When

starting cold, the thermostat remains closed and the warmed water from around the cylinder head circulates around the manifold. At the other end of the temperature range, a slight reverse thermo-siphon action occurs, so that, under conditions of high engine temperature, the heat of the inlet manifold is, to some extent, controlled.

Ignition is by normal battery and coil, with automatic spark advance and retard, but for the benefit of those driving where widely varying grades of fuel may have to be used, there is an over-riding manual device operated from the driver's compartment for controlling the spark timing.

A Daimler feature for many years has been the

Morgan chassis showing the unusual location of the components, particularly the transmission.



employment of a fluid coupling and preselector gearbox. Both these units are retained in this latest model, but the fluid coupling has been modified by the elimination of the annular ring on the rotating members. As a result, it has been found that a better grip is obtained at low rpm, with consequent improvement in acceleration.

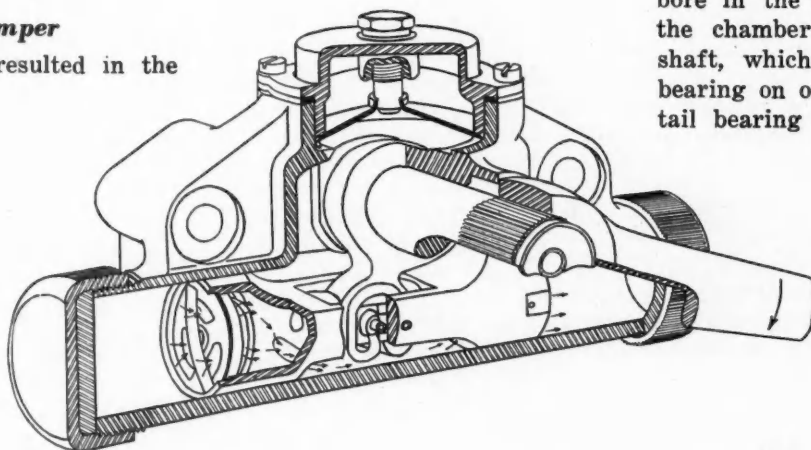
A built-in jacking system is provided to facilitate wheel changing. It is showing in the accompanying illustration of the Daimler chassis.

Luvax-Girling Hydraulic Damper

Considerable research has resulted in the new Luvax-Girling hydraulic damper, which is used on many of the British 1946 cars. If reference is made to the cut-away illustration it will be seen that the damper consists of a horizontal cast-iron main body of cylindrical shape, with a vertical chamber above the middle. The cylindrical part is bored out and ground to a fine finish and contains two horizontally opposed pistons, the heads of which face outwards. Each cylinder end is closed in by a screwed cap

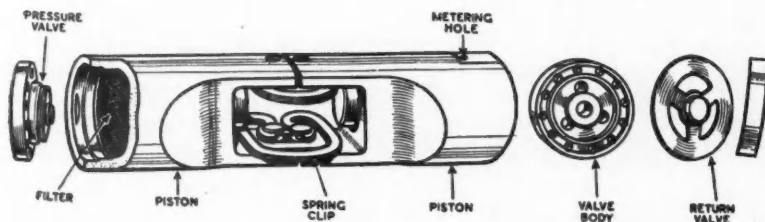
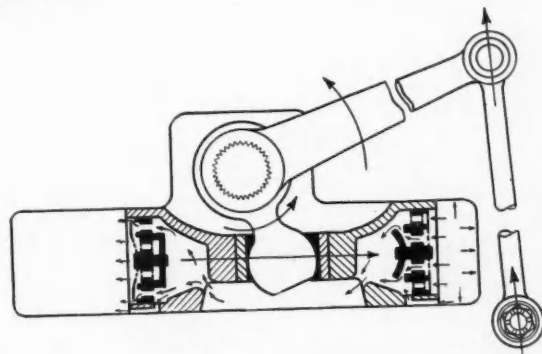
containing a shallow distance piece and a thin fibre sealing washer. The outside of the cap is serrated and during the process of assembly a serrated ring spanner is mechanically operated to screw on the cap sufficiently tightly to compress the washer in order to make a permanent pressure-tight joint.

The piston (see the assembly sketch) skirts are cut away except at the sides, in order to leave room for the assembly of the rockers. Mounted laterally at a point above the cylinder bore in the rigid wall of the chamber is a rocker shaft, which has a main bearing on one side and a tail bearing on the other

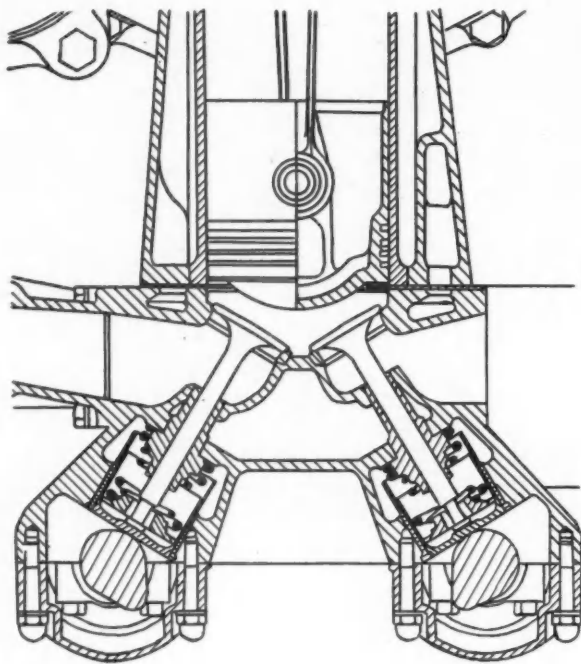


(Above) Cutaway sketch of the Luvax-Girling hydraulic damper.

(Below) Twin-piston assembly of the new Luvax-Girling damper.

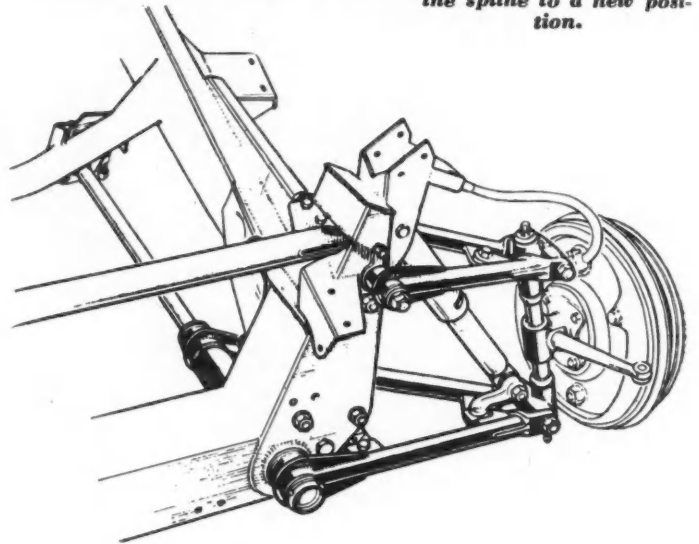


(Above) Fluid squeezes through metering port. If movement is rapid, fluid pressure builds up and forces the pressure valve open. The fluid displaced then flows through the body, opens the return valve in the left piston, and keeps the cylinder full.



(Left) New 158.6 cu in. Lagonda engine uses two overhead camshafts, the valves being actuated by means of inverted steel pistons. The shafts are driven by roller chain. The sketch shows the details of the construction, which includes inserted wet liners, inserted valve seats, and valve guides directly in contact with the cooling water. The so-called Specialoid piston is pressed to shape from an extruded billet.

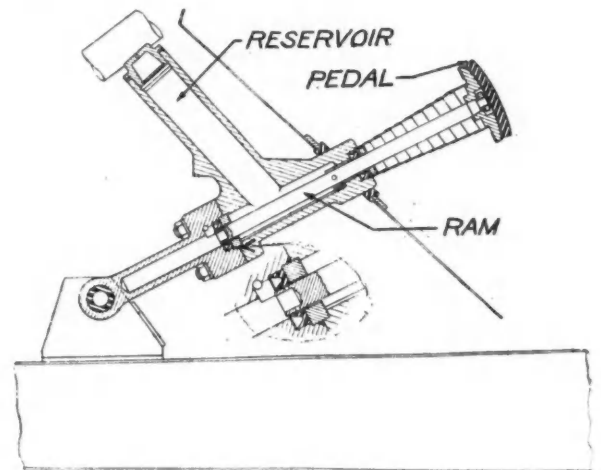
(Below) Sketch of the Riley Twelve front suspension showing the prestressed torsion bar installed longitudinally inside the frame and the double wishbone linkage with its telescopic hydraulic damper. The rear end of the torsion bar is splined and held in a special rubber mounting. Adjustment for stiffness of springing is made by turning the spline to a new position.



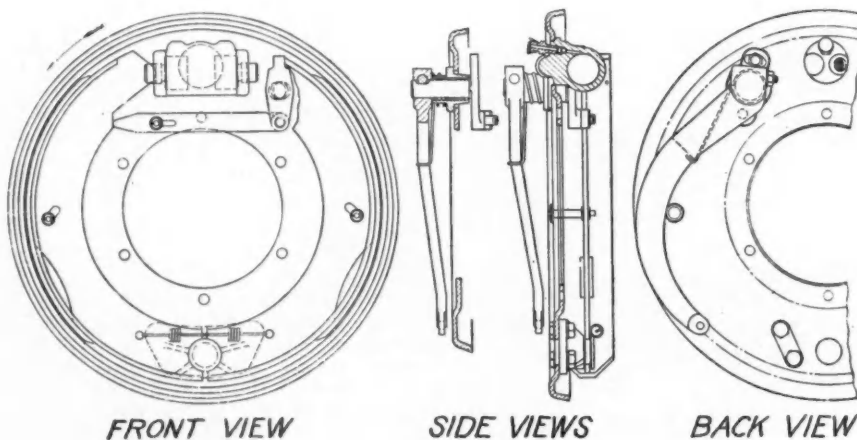
side of the chamber. Attached to this shaft on splines is the rocker itself, having its hardened lower end shaped into a circular form. Within the body of each piston is a hardened steel pad. U-shaped springs clip the inner ends of the pistons toward one another and ensure a chatter-proof contact between the foot of the rocker and the pad of each piston. The spring pressure automatically takes up wear.

Where the end of the rocker shaft projects from the main bearing there is a recess into which a thick rubber washer is inserted under pressure. This washer makes a gripping contact within its housing and on the rocker shaft, thereby providing an oil seal. When the shaft rocks the rubber washer twists torsionally without slipping. The outer end of the rocker shaft is splined and carries the actuation arm, which is coupled to the car axle by a link with torsional rubber cushion bearings.

The whole body of the damper is filled with a thin oil which has an almost constant viscosity at all normal working temperatures. This fluid completely fills the working



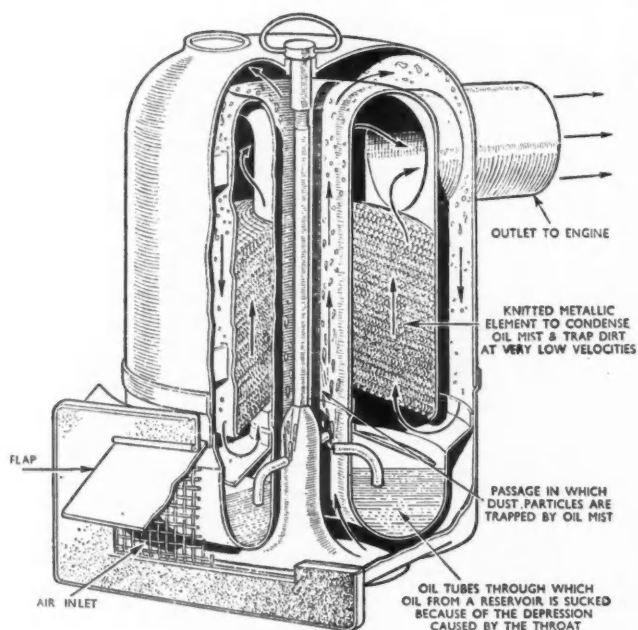
(Above) Layout of master cylinder and pedal of the Girling "Hydrastatic" brake.



(Left) Arrangement of hand and foot brake on a rear wheel used in the new Girling system.

chambers of the two cylinders and the recuperation chamber provided by the space between the pistons and around the rocker. A flat is cut for a short distance on the outer circumference of each piston head, and a fine port is drilled from this point to behind the piston crown. In this port is placed a metering pin, of a size suited to the work which the individual damper is to perform. When a piston is moving outwards the fluid thereby put under pressure in the working chamber is forced through the metering port and into the recuperation chamber, thus providing the needed frictional resistance.

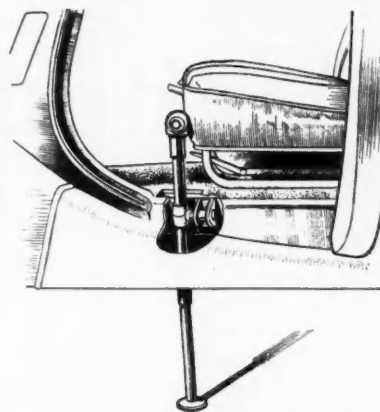
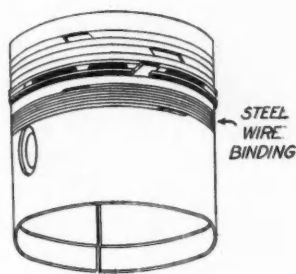
If this port were the only one the range of work which the damper could handle would be limited, and also a cavitation would be formed in the working chamber of whichever piston was moving inwards. Hence a system of valves is also essential. The crown of each piston is formed by a partition which is har-



New Air Filter Design

dened and pressed into place. The partition has a series of ports around its center, and at the back of it is a valve seat formed with a face of hemispherical cross section. On this seat rests a disk-type pressure valve built up of spring steel laminations. These are located by a central rivet, which puts a predetermined pressure on the center of the disks and causes the outer circumference to form a line contact upon the curved face of the seating. When the fluid is forced under high pressure through the ports by the action of the damper this simple valve opens sufficiently to allow a restricted flow. The line contact and the shape of the seat is said to ensure that the pressure valve is self cleaning. So the primary action of the damper has two phases—In phase 1, when the car spring movement is slow, the restraining friction in the damper is caused by the passage of fluid through the metering port in the piston. In phase 2, when the

(Below) The light-alloy piston used in the engine of the Wolseley cars is wrapped with several coils of steel wire and is said to maintain practically constant clearance between the piston and cylinder wall.

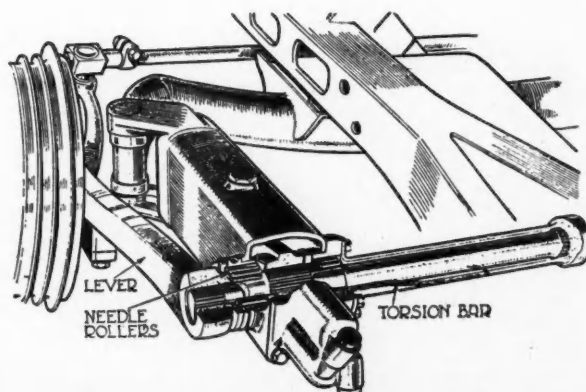


(Above) Wolseley car built in jack system.

spring movement is rapid, an excessive resistance is prevented from building up by the opening of the pressure valve.

There is also a second or return valve in each piston crown. On the outer face of the partition plate is a seat for a disk valve, and a ring of return ports. The valve is formed in the shape of a disk with arms running toward the center, where there is a central locating pin. A spring blade is anchored at its extremities in the head of the piston, and at its center bears upon the head of the return valve locating pin, thus holding the valve shut. Normally the return valve remains closed, and when pressure is built up by the movement of the piston outwards into the working chamber the valve is held even more firmly upon its seat. When, however, the piston is moving inwards on its return stroke and the pressure in the working chamber is reduced, the return valve automatically opens and allows the fluid to flow freely back from the recuperation chamber, and into the working chamber, thus filling the last mentioned ready for the next

(Turn to page 70, please)



Torsion bar front suspension used on the Vauxhall models for 1946.

Aptitude Testing of Ford

THE success of modern industry has been built on its scientific study and analysis of materials and methods of production. Every portion of material which goes into a modern product is bought on specification. Before it is accepted it is tested and inspected to see that it conforms to the specifications. In the process of manufacture similar careful inspections are given at the various stages of progress. Today industry is beginning to apply the same scientific approach to its manpower materials both in the field of selection and in the field of personnel development or human engineering.

The Ford Motor Co. is taking active leadership in this field. It is viewing every prospective employe from the standpoint of his qualifications as they apply to the job for which he is being considered. Naturally before his qualifications can be considered in terms of the needs of a specific job, the job itself must be analyzed

and described, its specifications must be written. These specifications are not limited to the work and skill requirements of the job. They also include the physical conditions of the job, its need for movement, the conditions of noise, temperature, and all other factors which relate to the welfare of the man who will fill it.

Just as industry knows that the right part must be fitted into the right place so it knows that the greatest success of its personnel program is assured when the right man is on the right job. The use of proper selection and placement techniques to improve personnel procedure in the Ford Motor Co. has been an established practice for years. In assisting the man

to find the job for which he is best fitted and in which he has the greatest chance of success, extreme care is taken to use every proven means of determining exactly where he can work best and have the greatest opportunities for increased development and productivity.

The selection techniques which have been proven and basically standardized include the following: weighted application blank and work experience review, a directed interview planned to obtain specific information which will help in establishing the man's qualifications for a specific job, a careful review of the essential references given by the man, a thorough medical examination, and selective testing to determine scientifically certain of the man's qualities as an individual. It is around the base of the selective testing that the entire selection procedure is patterned.

The progress that has been made in the scientific development of these tests now enables us to establish a high percentage of accuracy in appraising the man's qualities in such things as mental alert-

By Fred A. Miller

Training Department,
Ford Motor Co.

STUDENT RECORD
FORD MOTOR COMPANY
TRAINING DIVISION
DEARBORN, MICHIGAN

RECORDS DEPT
FORM 4403

IDENTIFICATION

NAME (Print) First Middle Last
BADGE NO. DEPARTMENT PLANT
ADDRESS Number Street City Zone
TELEPHONE Home Company DATE

RECENT PHOTOGRAPH
Sign Front of Photograph
Size
Approx. 2 x 2

EDUCATION

Birthplace
Date of Birth Marital Status Veteran I or II
Grammar School High School College Other School
3 4 5 6 7 8 1 2 3 4

SELECTIVE TESTS

QUALITIES
Mental Level
Mechanical Aptitude
Personality
Leadership Potential
Vision
Hearing

Uns. Poor Avg. Good Sup.

SPECIAL ABILITIES

Foreign Languages
What are your hobbies?
How much leadership experience have you had? (e.g., Scout Leader, Air Raid Warden, Committee member or chairman, Work leader, Foreman, etc.)

REMARKS

Ford student record form for aptitude testing

Workers

ness, aptitudes for specific kinds of work and learning, certain personality traits which will be helpful on specific kinds of jobs, inventories of the basic interests which the man has, and specific measurement of his knowledge, skill and abilities in various subjects or kinds of work.

The mental alertness factors allow us to predict with a high degree of accuracy how quickly a man will be able to learn, the areas in which he can probably learn best, and probably his actions in emergency situations.

The determination of aptitudes allows us to predict his probable success on jobs which demand skill and ability in the various types of coordination, the dexterity of hands and fingers, mechanical comprehension in the fields of understanding mechanical relationships, and many others.

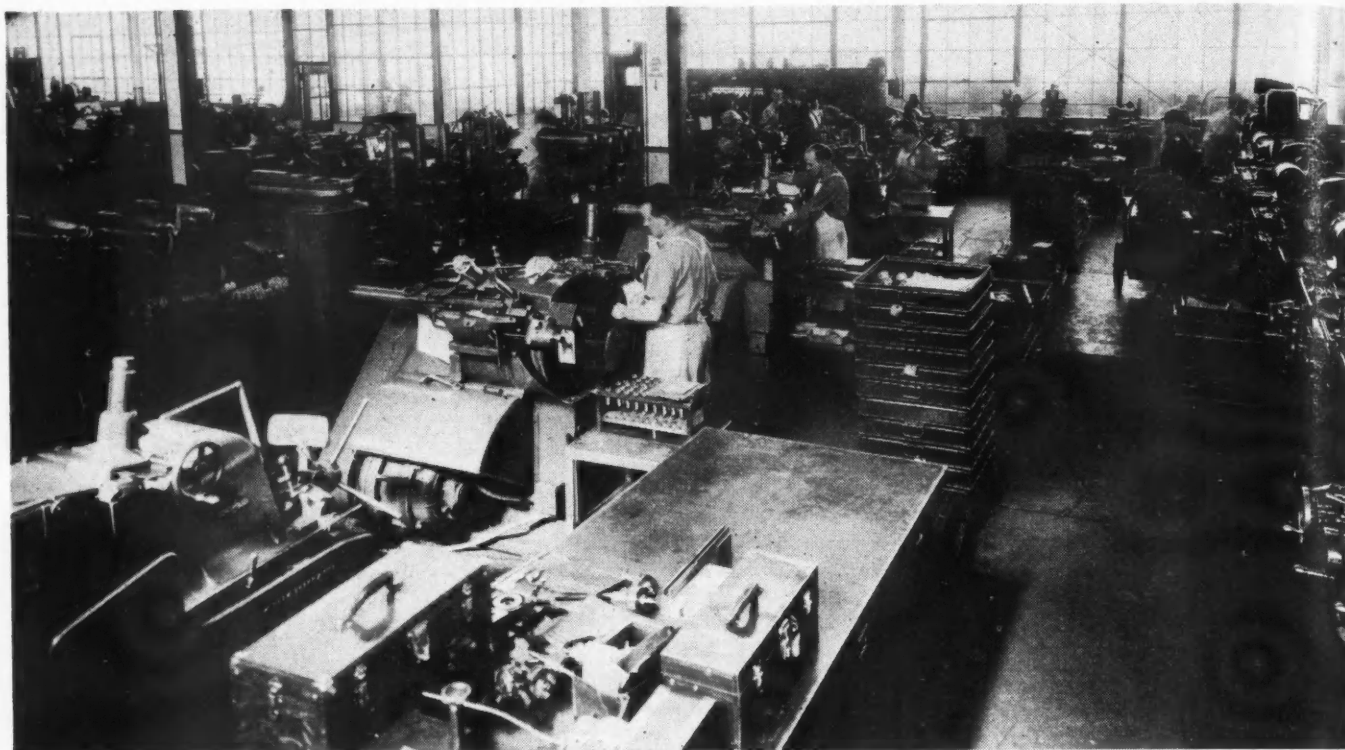
The measurement of personality traits tends to show how well the man will work with other people, the kinds of reactions he will have to situations on the job as well as some of his habits of thinking when he is dealing with problems.

The interest inventories show where his natural interests lie. Many men in the past have worked at specific jobs that their major interests have been in their hobbies. A careful analysis of interest and the placement of men on jobs in which these interests can be served will naturally lead to the fuller satisfaction of the individual men in their jobs and work experiences.

The testing of knowledge, skills, and abilities, show the degree of a man's training in specific lines. They show
(Turn to page 67, please)

Sample of selective testing graphic record used by Ford Motor Co.

GRAPHIC RECORD		FORD MOTOR COMPANY		SELECTIVE TESTING							
EDUCATION 1 2 3 4 5 6 7 8 9 10 11 12		COLLEGE 1 2 3 4		NAME							
BUSINESS COLLEGE 1 2 3		PRESENT JOB		AGE							
TRADE OR INDUST. EDUC.				DATE							
LETTER MARK	PERCENTILE RANK	E	D	C	B	A					
MENTAL LEVEL	NON-VERBAL	0	10	20	30	40	50	60	70	80	90
MENTAL LEVEL	VERBAL										
VOCABULARY											
READING RATE											
COMPREHENSION											
APTITUDES											
ASSEMBLY											
COORD. MUSCULAR											
COORD. HAND-EYE											
DEXTERITY-FINGER											
DEXTERITY-HAND											
MECH. COMPREHENSION											
PRECISION											
SPATIAL RELATIONS											
VISUALIZATION											
PERSONALITY											
COOP. TENDENCIES											
DEPENDABILITY											
EMOTIONAL STABILITY											
EXTROVERSION											
OBJECTIVE TENDENCY											
SELF RELIANCE											
SOCIAL ADJUSTMENT											
TRADE TESTS											
ACHIEVEMENT TESTS											
E = LOW		D = BELOW AVERAGE		C = AVERAGE		B = ABOVE AVERAGE		A = HIGH			
PERCENTILE RANK											
NAME											
LETTER MARK	PERCENTILE RANK	E	D	C	B	A					
VOCATIONAL INTERESTS		0	10	20	30	40	50	60	70	80	90
AGRICULTURAL											
BUSINESS COMMERCIAL											
CLERICAL											
COMPUTATIONAL FISCAL											
ENGINEERING											
LEGAL LITERARY											
MECHANICAL											
PERSONNEL SOCIAL											
PROMOTIONAL PERSUASIVE											
ROUTINE WORK											
SCIENTIFIC											
CLERICAL ABILITY											
ARITHMETIC - PROCESSES											
ARITHMETIC - REASONING											
DETAIL - SPEED											
DETAIL - ACCURACY											
FILING											
HANDWRITING											
SPELLING											
ENGLISH COMPOSITION											
TYPING	W. P. M.										
DICTIONATION	W. P. M.										
TRANSCRIPT	W. P. M.										
VISION											
HEARING											
PRACTICAL EXPERIENCE											
TESTED FOR	ASSIGNMENT										
SUMMARY											



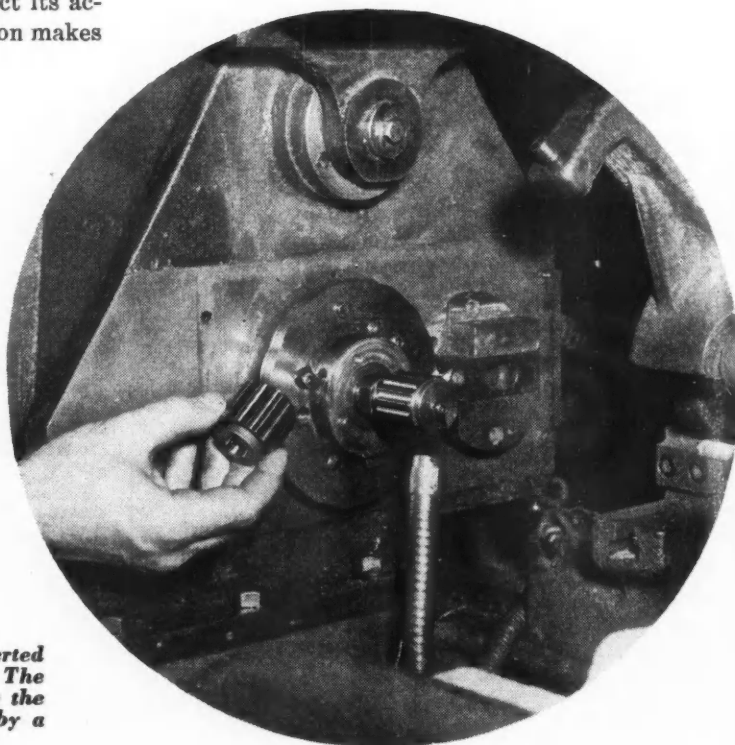
Scintilla's Self-Contained

for Producing Ignition Equipment and Diesel

By Joseph Geschelin

ALTHOUGH generally known in industry as a producer of aircraft magnetos, the Scintilla Magneto Div., Bendix Aviation Corp., Sidney, N. Y., does not restrict its activities to magnetos alone. Actually the organization makes a complete line of ignition systems for aircraft engines, a variety of switches, coils, complete wiring harness assemblies, and spark plugs. Moreover, the automotive and marine field is being served with a line of industrial magnetos, wiring harness for trucks and buses, and flywheel type magnetos for one- and two-cylinder engines. This scope of products is further rounded out by a line of fuel injection pumps, unit injectors, nozzles and holders for Diesel engines.

Because of its location in a small community in the hills of Central New York State, and because of a desire to keep as much work as possible under its own control, Scintilla has created a self-contained and self-sufficient operation capable of making



Close-up of Heald internal grinder converted for the contour grinding of 18-lobe cams. The machine guard has been removed to show the oscillating work-head which is controlled by a master cam.

(Left) General view in the steel machining department showing—in foreground—a battery of Cincinnati Centerless grinders, grinding nozzle needles.

(Right) Here is one of the double-end Heald Bore-Matics in the light machining department. As described in the text, it has three work stations—two spindles at the left and a third spindle at the right.

This is the 117th
in the series of monthly
production features



Setup

Fuel Injection Systems

everything it needs—including cutting tools and jigs and fixtures, as well as molds for ceramics, rubber and plastics. Extended to the product, it includes the manufacture of coils, stampings, ceramics and plastics and rubber parts.

Reconversion presented a problem unique in the parts making field. For some years before World War II and during the war the emphasis was on aircraft ignition in all its ramifications. During the war mili-

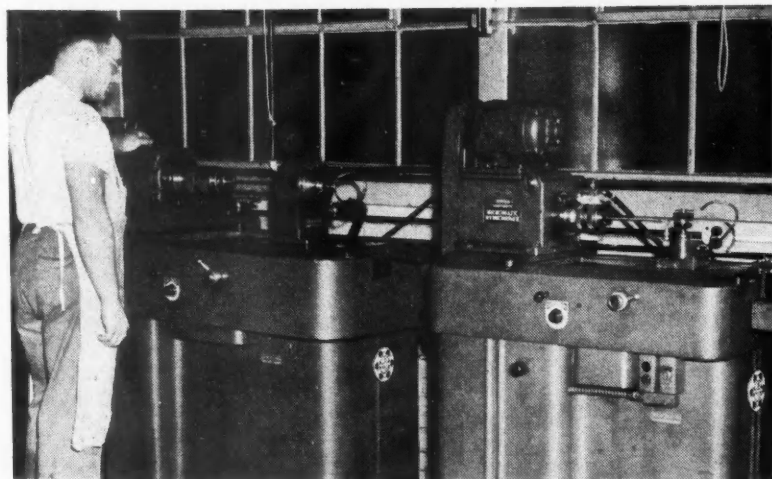
Part One

PART TWO will appear
in the next issue.

tary aircraft, tank and PT boat needs were so enormous as to demand equipment and plant layout aimed exclusively at mass production. Consequently, most items were made in self-contained departments on conveyorized lines suited to the rapid pace.

In the shift to postwar activity, it was necessary to remove most traces of specialization and to develop a departmentalized setup more in keeping with a tremendous variety of products made in relatively small volume. On the other hand, postwar manufacturing with its greater emphasis on industrial and commercial products is rapidly resulting in the creation of new self-contained mass production departments such as the one for flywheel-type magnetos.

Before we turn to the study of the plant layout and specific examples of manufacturing methods, it is pertinent to comment on the historical background of the company. The early Scintilla magneto had its beginning around 1915 in Soleure, Switzerland, where a group of Swiss engineers formed an aircraft ignition production project to provide magnetos for military use by the French, Italians, and the British in World War I. Then came the formation, in 1921, of the Scintilla Magneto Co., Inc., with offices in New York City, to act as a sales agency for distribution in the U. S. A. By 1925 the virtue of Scintilla



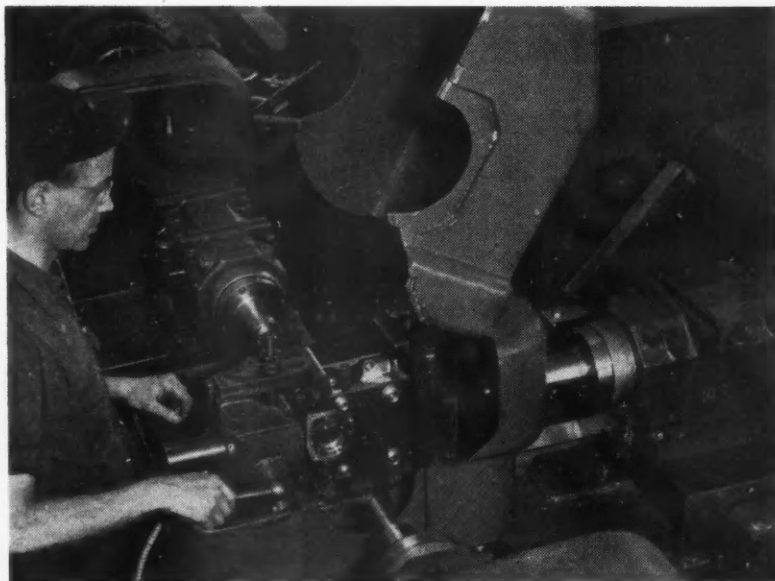
In the fuel injection department—a group of Micromatic Hydrohonors for the honing of 15 mm fuel injection pump barrels.

ignition had become so well recognized by the U. S. Army and Navy as to create a growing demand and with it a need for domestic manufacturing facilities.

The search for suitable facilities eventually resulted in the purchase of a group of factory buildings in Sidney, formerly occupied by the Cortland Cart and Carriage Co., also manufacturers of the Hatfield automobile. In contrast with the enormous production attained during World War II with the employment of 8600 workers, the early project began with 15 employees and had an output of 10 magnetos a month. In 1929, the Bendix Aviation Corp. acquired the Scintilla Magneto Co., Inc., later making it one of its divisions.

Coming now to the present plant layout, it will be noted first that the operation is housed in a single building of modern construction with ample space for the expansion of existing departments. In keeping with modern methods the flow of materials starts from one end, progressing through the production department and finally reaching the assembly departments at the other end. The receiving end of the plant contains the incoming inspection department, and storage facilities for bar stock and castings. At this end also is handled the shipping of finished products, including the making of boxes and shipping cases, and facilities for the export packing of parts, stemming from military specifications developed during the war.

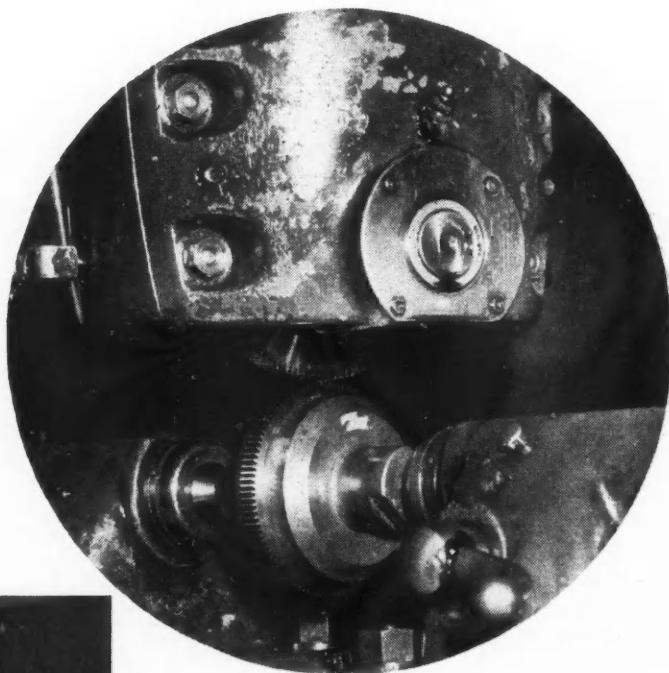
Because of the variety of products and multiplicity of models, the management has concentrated upon a layout in keeping with lot production. And this has resulted in the establishment of a number of individual departments, capable of handling the full gamut of parts in a scheduled flow over the machines. Taken in order, the first of these is the automatic department which contains a large battery of National Acme-Gridley, Brown and Sharpe, and Gorton Peterman machines. Every part which can be produced economically on automatic screw machines is routed through this department, in which are available all the machines needed for secondary operations on screw machine parts.



Adjacent to this is the "sundry" department. Equipped with general purpose machinery of every kind and operated by highly skilled workers, it handles all manner of small lots and short runs and experimental production. The department is capable of turning out samples or small lots in advance of regular production, thus relieving the burden on the production department and permitting a flow of experimental and semi-production manufacture without interfering with regular schedules.

Since the normal range of product includes both ferrous and non-ferrous parts, it was felt desirable to further sub-divide departmental functions into ferrous and non-ferrous groups. This makes possible a specialization both in equipment and in manpower. Accordingly, we find a steel machining department of large size equipped with the latest types of machines for grinding, turning, cam-grinding, gear cutting and gear finishing, drilling, precision boring, centerless grinding, etc. In short, every conceivable facility for the machining of ferrous parts.

Here are installed Cincinnati Filmatic grinders, Cincinnati Centerless grinders, Heald Bore-Matics, Delta



(Above) Workhead of one of the National Red Ring gear shavers in the gear department. These machines are used for the shaving of spur and helical gears, using a circular cutter as shown.

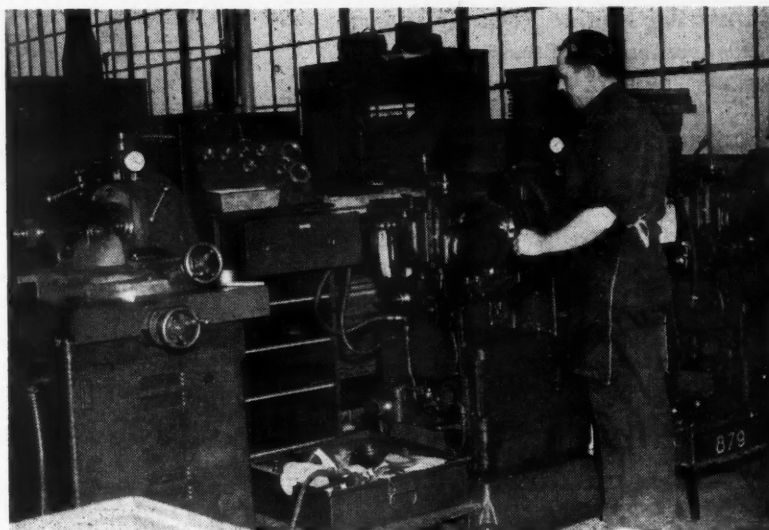
(Left) Outstanding example of precision boring is this three-way Ex-Cell-O machine in the light machining department. It is set up on an 18-cylinder magneto housing, takes the rotor bore, cross holes, and retainer seat bores in one setting as described in the text.

Gleason generators for cutting spiral bevel gears in a variety of sizes are found in the steel machining department.

drills, various makes and types of lathes familiar Lo-Swing Imp lathes, LaPoin broaching machine, American vertical broaching machine, a battery of Nichols hand mills, a large battery of Sundstrand mills, Hanson-Whitney thread millers, and a large Detrex degreasing machine using Permachlor fluid for the cleaning of finished parts. There is also a self-contained gear department with a large battery of Barber-Colman hobbing machines, a battery of Fellows high-speed gear shapers, and a number of modern Gleason generators for producing bevel gears. The gear department also boasts a group of Red Ring gear shavers which are used for the finish shaving of spur and helical gears to correct distortion in heat treating.

In the normal course of events it sometimes is necessary to develop special means for the economic handling of unique operations which otherwise would demand the design of special purpose machines at a cost completely out of line with anticipated volume. Such problems have been solved most ingeniously by the conversion of available standard equipment together with the development of special attachments and fixtures. One example is the conversion of a small Barber-Colman hobber for milling internal threads. Another is the cam-grinding of large ignition cams on a Cincinnati grinder fitted with a special cam attachment permitting the use of a large grinding wheel.

By far the most impressive device of this kind is found in the conversion of a Heald internal grinder for the grinding of small cams for 18-cylinder engine magnetos. This cam has 18 lobes, each one with a different dwell and unequal spacing from one lobe to another. The machine was fitted with an oscillating workhead designed and built by Scintilla, the move-

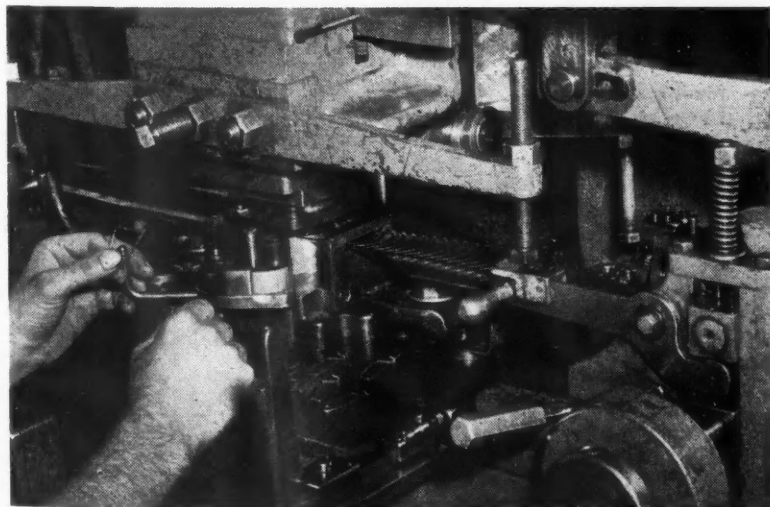


ment of the head being controlled by a relatively large master cam template.

The "steel machining" department does not handle processing—heat treatment, electroplating, shot blasting, etc. Comments on the process departments will be made later. There is a small punch press department adjacent to the steel machining department, equipped with a battery of 35-ton V & O presses and producing principally the laminations for the magnetic circuit of magnetos. Such laminations as are required in sufficiently large volume are produced in presses fitted with automatic feed and with an automatic counting attachment at the other end of the bed. When fitted with these attachments, the press produces blanks which are stacked in a hopper and "chopped" off to proper height by the automatic counter. Later these stacks of counted laminations are checked for height or thickness within a narrow range of tolerance, the adjustment being made selectively by varying the thickness of one or more of the top laminations.

The light-metal machining department operates on the same principle as does "steel machining" except for differences in the size and character of the equipment. It is responsible for the finish-machining of aluminum and magnesium parts as well as die castings. Much of the equipment consists of large one- and two-way Heald Bore-Matics, Ex-Cell-O precision boring machines of various types, Delta drills, some Ex-Cell-O three-way precision boring machines, 4-Spindle Hydrotel profiler, Sundstrand automatic milling machines, Cincinnati vertical mills, Natco multiple spindle drills, and a horizontal

(Turn to page 96, please)



Close-up of the work station of one of the V & O presses in the punch press department. It handles the piercing and blanking of laminations and is provided with the attachment at the right for automatically counting and stacking.

Improving Engine Parts by Direct Measurement of Strain

By R. G. ANDERSON
Aluminum Co. of America

AN INCREASE in the maximum allowable operating speed of rotating parts can often be obtained by so-called "overspeeding." For simplicity, a uniformly thick circular disk with a central hole will be used as an example. It is assumed that the thickness of the disk is relatively small in relation to its diameter and homogeneous material is used for its construction. Upon rotating this disk, tangential stresses are set up in the metal surrounding the

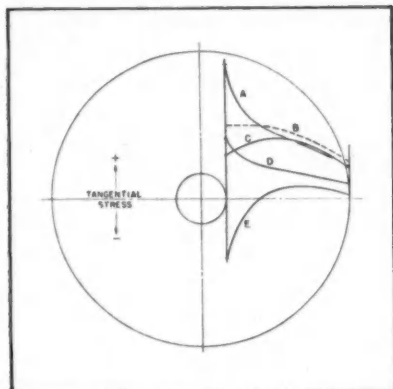


Fig. 1—Beneficial prestress obtained by overspeeding a rotating disk.

central hole. The tangential elastic stress distribution, symmetrical about the axis of the disk, can be illustrated by Curve D in Fig. 1. Upon increasing the rotative speed of the disk, a speed is reached at which the metal surrounding the central hole has been stressed above the proportional limit but below the ultimate strength of the material. The theoretical stress distribution for this condition, assuming elastic action, can be illustrated by Curve A. This stressing is not compatible with the yield strength and a more nearly correct distribution is shown by the broken line, Curve B. Upon stopping the disk, a tangential-residual stress condition will be set up. These residual stresses result from the permanent set of the material at the hole. The portion of metal which has yielded is compressed by the elastically strained outer portion and equilibrium is established by the tensile stresses set up in the outer portion.

The tangential residual stress, produced at the hole by stressing the material in the plastic range, is opposite in sign to the stressing produced by rotation of the disk. This condition produces a favorable effect on the final distribution of the stresses in the disk.

When the disk is again rotated, the tangential stressing in the disk may be obtained by the algebraic addition of the elastic Curve A and the residual Curve E. The stress distribution under

this condition will be as shown by Curve B. The stress distribution for any speed below the proof speed may be obtained in this manner.

If the proof test speed is set to produce stressing as shown by Curve B, the stress distribution at the rated speed will be represented by the Curve C. The maximum tangential stress in Curves C and D are equal. If Curve D represents the tangential stress distribution at the maximum rated speed where the stresses are within the initial proportional limit of the material, the increase in speed as the result of overspeeding will be the difference in speed required to produce the stress distributions as shown by Curves D and C. Upon increasing the rotative speed of the disk above the previous maximum speed, yielding will again take place and a new level of residual stresses will be set up on returning to zero speed.

Crankcase Scavenge Target Engine

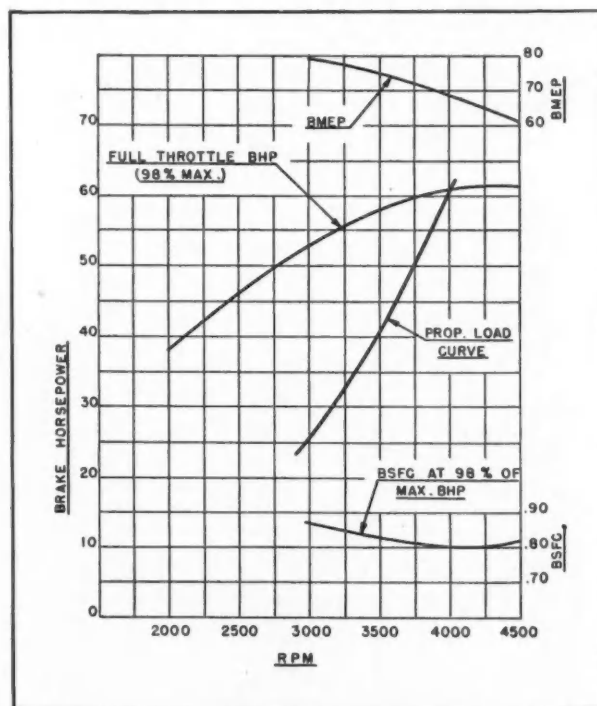
By JOHN L. RYDE
McCulloch Aviation, Inc.

THE radio controlled target airplane is one of the little publicized but very interesting developments that has come out of the war, and particularly,

the small non-man-carrying or "scale model" targets. These small ships, approximately one-fourth scale, are launched by catapult and landed by means of a self-contained parachute. The special functions of these small airplanes present a number of engine problems, and the two-stroke crankcase scavenged engine has been used in nearly every case.

The design and development of a four-cylinder engine, designated the Model 4300 was completed in 1944 and test flown in January, 1945. The bore and stroke is 3 by 3½ in., giving a total displacement of 88.3 cu in. It was designed to operate on a mixture of 80 octane gasoline and lubricating oil, the oil in proportion of eight per cent by volume. The compression ratio for this fuel was 7.2 to 1. Later, the fuel specification was changed to 91 octane and the compression ratio raised to 8 to 1. To obtain as simple an arrangement as possible no gears were used, and all of the accessories were driven from the crankshaft free end. The magneto is driven directly at the end of the crankshaft. The generator is mounted below and is driven by a belt from the engine half of the magneto coupling. The fuel pump is one of the new "miniature" diaphragm pumps mounted below the engine. It is driven by a pin running

Fig. 2—Model 4300 target engine (88.3 cu in.) performance curves.



Aeronautic Meeting

on an eccentric ground on the crankshaft just behind the rear main bearing.

With the exception of the center main, all the bearings are of the anti-friction type. This bearing design was selected to permit the use of as small amount of oil as possible in the fuel mixture. With anti-friction bearings, the lubrication is very satisfactory with the above oil mixture, and the plain center bearing is the only reason for maintaining this amount. Later tests on similar engines have indicated that a substantial reduction can be made in this quantity, as the cylinder lubrication is more than adequate.

The pistons have flat tops similar to four-stroke practice. The inlet ports are arranged to provide the necessary loop flow without deflectors. The conventional deflector is a source of trouble at high outputs, and with the smooth top piston, the heat input is less and the piston runs cooler. The two crank cheeks adjacent to the center main bearing sections are disks with suitable cutouts and together with this section form the rotary valves for the admission of charge to the crankcases fore and aft. The fuel is admitted in a venturi located in the air scoop just above the center bearing section.

After completion of the initial experimental work, with 80 octane gasoline and the lower compression ratio, the brake output was over 60 hp at 4000 rpm corresponding to a bmep of over 68.0 psi as shown in Fig. 2. The cooling at maximum power was very satisfactory in that the cylinder head temperatures were less than 360 F measured under the spark plug. At maximum power and rpm, cylinder base temperatures averaged less than 220 F. The engine could be operated continuously at full throttle on the test stand with either the test club or flight propeller.

Investigation of an Opposed Piston Light Aircraft Engine

By JOHN W. OEHLRI
and V. J. JANDASEK
McCulloch Aviation, Inc.

THE tests described here were conducted on a single cylinder test engine of the opposed-piston, spark ignition type with a 3 in. bore and 2.5 in. stroke, each crank having total displacement of 35.3 cu in. The cylinder is located horizontally on the front face of the cast gear box which is the main structure and the overhung cranks are housed in separate cases. Nuts ad-

Large Attendance of Engineers at National Meeting in New York City

OVER 650 engineers, representing a good cross section of the development and administrative leadership of the American aeronautical industry, turned out for the SAE National Aeronautic Meeting April 3-5 in New York City. Military and Naval top rank also were well represented. At the final session Myron Tribus, University of California, was awarded the Wright Brother Medal in recognition of his paper, "Report on Development and Application of Heated Wings."

The abstracts that follow give the highlights of some of the papers that were presented at the technical sessions. Excerpts from other papers will be published in *AUTOMOTIVE and AVIATION INDUSTRIES* in the near future.

Adjacent to one crankcase position the cylinder axially and thus facilitate changing the port timing. The intake crank and crankcase assembly are movable horizontally to provide variable crank centers. Since the cranks are overhung and relatively simple in design, they are easily replaced and thereby provide a means of changing the stroke.

The drive is transmitted from the cranks to combination spline and flange type couplings permitting rapid adjustment of the angular relation of one crank with the other. This feature was very useful in the determination of effect of phase angle variation on performance. From the couplings, the drive is taken through spiral bevel gear sets to the output shaft of the engine which is coupled to a dynamometer at one end and drives the accessories through a spur gear at the opposite end.

Fig. 1 presents the air and fuel flow characteristics obtained from the single cylinder research engine at 4000 rpm. The results shown are the averages of many runs and represent data as observed at 29.2 to 29.7 in. hg barometric pressure with a 200 F inlet manifold air temperature before fuel injection. This represents an ample allowance for conservative supercharger performance with inlet temperature of 110 F and higher manifold pressures than required. Both air-cooled and liquid-cooled cylinders are represented in the above data. The indicated horsepower was determined conventionally as the sum of the brake and friction horsepower for each test run. All tests were run with 80 octane fuel.

It is to be noted that the power output is approximately proportional to the breathing capacity of the engine as shown by the air consumption in Fig. 3. Further, the air consumption in per cent of piston displacement indicates that air is not being wasted, which is remarkable since a flow of 75 per cent

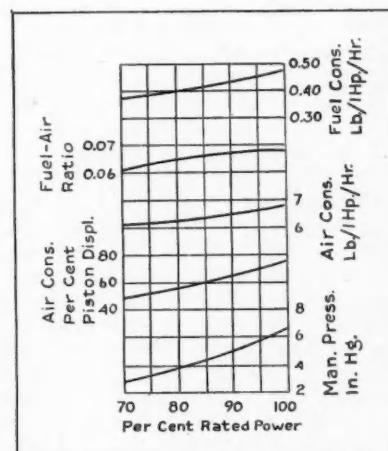


Fig. 3—Air and fuel flow vs. indicated horsepower at 4000 RPM.

of the piston displacement represents an output of one bhp per cu in. The indicated specific air consumption compares very favorably with the best large four-stroke engines. Fig. 4 is shown primarily to illustrate the range of fuel-air ratios permissible for steady

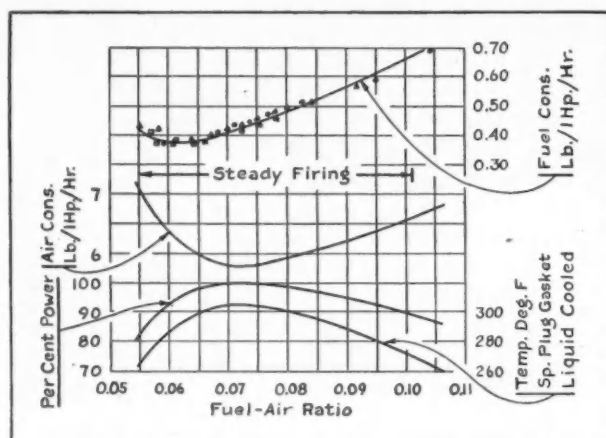


Fig. 4—Performance vs. fuel-air ratio at 4000 RPM (73 per cent).

firing of the charge. This is quite similar to good four-stroke performance. The fuel consumption curve shown is the average of four separate tests obtained with various cylinders, port dimensions and timings.

The most important factor affecting scavenging efficiency and manifold pressure was found to be the exhaust blowdown factor. We define this term as the product of exhaust port area and the time interval from exhaust port opening until the inlet port opens. With the shape of ports used in our work, an accurate approximation is one-half the total exhaust port area in sq in. at end of blowdown times the interval in crankshaft degrees. Although the crankcase oil flow is increased to provide piston cooling, adequate cylinder wall lubrication was attained with oil consumption values of 0.007 to 0.012 lb per bhp-hr.

Maximum Lift as Affected by Variations of Mach and Reynolds Numbers

By JOHN R. SPREITER
and PAUL J. STEFFEN

NACA, Ames Aeronautical Laboratory

A COMPILATION has been made of maximum-lift-coefficient data obtained in flight with six pursuit-type airplanes embodying typical conventional and low-drag airfoils. These flight data, obtained in gradual stalls over a range of Mach numbers from 0.15 to 0.72 and of Reynolds numbers from 4,400,000 to 19,500,000, have been analyzed together with pertinent model and airfoil data obtained in several wind tunnels.

It was found that the maximum lift coefficient varied with Mach number down to Mach numbers of approximately 0.15. When the effects of Mach number were considered, as well as those of Reynolds number, good correlation was found to exist between flight data and available wind-tunnel data, provided buffeting or other factors did not prevent attainment of the actual maximum lift coefficient. The same considerations provided good

agreement among limited airfoil data from various wind tunnels.

At subcritical Mach numbers, the maximum lift coefficient obtainable in gradual stalls decreased steadily with increasing Mach number for all airplanes tested. The effects of Reynolds number were determined for three of the airplanes and found to be qualitatively as described in NACA Rep. No. 586; quantitatively, the effects of Reynolds number on the maximum lift coefficient decreased progressively with increasing Mach number, becoming nil at a Mach number of approximately 0.55. The critical Reynolds number increased nearly linearly with Mach number.

In the supercritical Mach number range, the gradual stall maximum lift coefficient of conventional airfoils continued to diminish with increasing Mach number, while that of the low-drag airfoils reached a minimum at a Mach number between 0.40 and 0.55 and then began increasing until secondary peak values were reached at a Mach number between 0.60 and 0.66. At supercritical Mach numbers, no effects of Reynolds number were apparent for two of the three airplanes on which pertinent data were obtained. On the third airplane the maximum lift coefficient was affected by Reynolds number but the phenomenon appeared to be basically different from that experienced at subcritical Mach numbers.

In comparison with the flight data obtained in gradual stalls, information regarding abrupt stalls indicates that the maximum lift coefficient increases approximately linearly with increases of pitching velocity and appears to reach a limit maximum lift coefficient at higher pitching velocities. This limit maximum lift coefficient appears to be relatively independent of Reynolds number but decreases rapidly as the Mach number increases. From available data, it appears that for Mach numbers of less than about 0.55, the value of the limit maximum lift coefficient was much greater for NACA conventional airfoils than for NACA low-drag airfoils.

Evolution of a New "Workhorse" Airplane for the Airlines

By M. B. BASSETT
Glenn L. Martin Co.

AN IMPORTANT question that had to be answered before even a preliminary new airplane design could be laid down on the drafting board was: How far do most air travelers fly? It was found that 69 per cent of air travel was under 500 miles, 12 per cent from 500 to 800 miles, and 19 per cent more than 800 miles. Thus, preliminary work established the necessity for providing a new workhorse airplane for ranges up to 500 miles with low-cost operation, higher speeds, improved passenger comfort, increased seating capacity and, of course, a high degree of safety.

Since twin-engined airplanes had established remarkable safety records and proved themselves satisfactory for medium ranges, economy was the criterion chosen for deciding the number of engines to install. After making and studying designs having two, three and four engines, it was found that the twin engine design was unquestionably the most economical for the following reasons: (1) less engine weight per installed horsepower, (2) less over-all airplane drag, (3) lower airplane first cost, (4) shorter time for engine run-up, starting, and airplane maneuvering, (5) less equipment and control weight, (6) higher cruising speed with more economy than an airplane with more engines when both types were designed for the same operating conditions to meet Civil Airworthiness Requirements.

Intimately tied in with airplane cruising speed are wing loading and size of power plant which were subjects for extensive research to determine the most economical combination. Many engineers and airline personnel argued that a slow airplane with small engines and large wings would be most economical while there were those who were equally convinced that a fast airplane could be obtained at no extra cost if higher wing loadings were employed. Two separate and distinct approaches were taken to secure the answer to this problem.

The first method was to make a series of actual preliminary designs employing different size power plants which were then available. The airplanes were designed to carry a fixed payload over average ranges of 400 to 800 miles. Each airplane had to be designed to meet certain operational limitations. For example, the Civil Airworthiness Requirements had to be met at a one-engine inoperative enroute altitude of 10,000 ft. The airport altitude limit for maximum take-off weight and for landings was 4000 ft.

The results of this first study, completed in 1943, showed that the faster airplanes with higher wing loading were most economical and that the only limit to wing loading was the high lift device which could be developed to meet the then existing limit of 80 mph for

stall speed. Landing distance was also found to become critical at higher stall speeds. For example, the landing distance required at a stall speed of 80 mph was approximately 3750 ft.

The change in operating cost with wing loading is shown in Fig. 6. Some of the factors which result in lower operating costs for the airplanes with higher wing loading are higher speed and reductions in over-all drag, in design load factors, in wing and tail weights, and in gross weight of the airplane to do a given job.

Instead of using actual power plants and designs, a comprehensive study was made assuming values for the weights of power plants, wings, etc., thus eliminating variables resulting from use of power plants of different manufacturers. A theoretical power plant just large enough to meet the operating criteria was assumed to be installed in airplanes with various wing loadings.

Since the theoretical airplanes were designed to carry a fixed payload 300 miles, the fuselage space was held constant. However, gross weight varied with wing loading, power loading and fuel. Cruising speed was allowed to vary for all airplanes and was computed at 60 per cent of normal rated power. As in the original study, certain criteria such as enroute ceiling and airport altitude were held constant.

Fig. 7 is a plot of per cent changes in operating cost versus wing loading. This curve indicates that the higher wing loadings, of approximately 40 to 50 psf, are most desirable. The practical limitation to the wing loading is the maximum lift coefficient that can be obtained for landing to permit use

of airports with reasonable runway lengths.

Development of Magnesium Alloys As Aircraft Materials

By J. C. DeHAVEN
Battelle Memorial Institute

VERY recent developments in foundry technology have pointed the way for the commercial production of low-impurity magnesium castings. There is reason to believe that in the not-too-distant future, magnesium castings made from low-impurity metal will be commercially available. The low, or zero, zinc-containing alloys may, therefore, be used, because with low impurities, these alloys have salt-atmosphere corrosion resistance equal to the higher zinc alloys. The low-zinc alloys have better feeding characteristics, require fewer risers, and are easier to heat treat than the higher zinc alloys. The techniques which may permit the production of the high-purity alloys in the foundry also show promise of cutting

production costs. This factor, plus the higher yield of castings made possible by use of the low-zinc alloys, should make available in the future, cheaper, more corrosion-resistant magnesium castings of very high quality.

While still on the subject of castings, it is in order to mention the elevated-temperature properties of some of the newer, cast-magnesium alloys. The usual magnesium alloys containing aluminum, or aluminum and zinc, exhibit a dropping off of mechanical properties, as their temperature rises above 250 F. The CM62 alloy, containing six per cent cerium and two per cent manganese, has lower room-temperature properties than the usual magnesium alloys, but retains a surprisingly large proportion of these properties up to temperatures in the neighborhood of 600 F. Experimental alloys of this general type, still in the laboratory stage, are showing even better room- and elevated-temperature properties than the CM62 alloy. Especially in the higher temperature ranges, they appear to be superior to any known aluminum-base alloys. Different melting practice must be employed for these alloys than for the ordinary magnesium alloys, and their foundry characteristics are not of the best. However, certain of the latter difficulties have been overcome, and continued investigations may point the way to practical methods for the manufacture of commercial castings. Because of their light weight and very good elevated-temperature properties, it is expected that these alloys will find application in such fields as gas-turbine compressors, pistons, and cylinder heads.

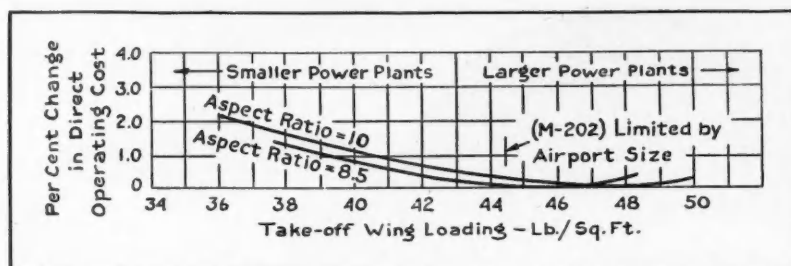


Fig. 7—Per cent change in operating cost vs. wing loading for two-engined transport at cruising 60 per cent meto power, constant payload, 300 mile range and 10,000 ft altitude.

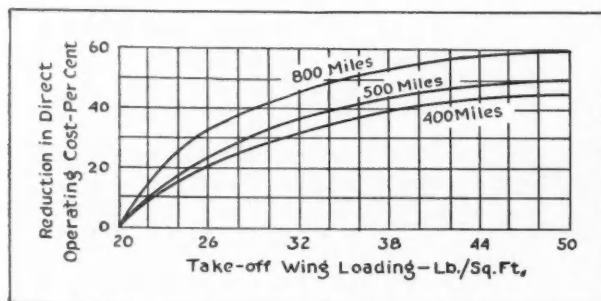


Fig. 6—Reduction in operating cost vs. wing loading for two-engined transport.

French Vehicle Tax for Increased Research

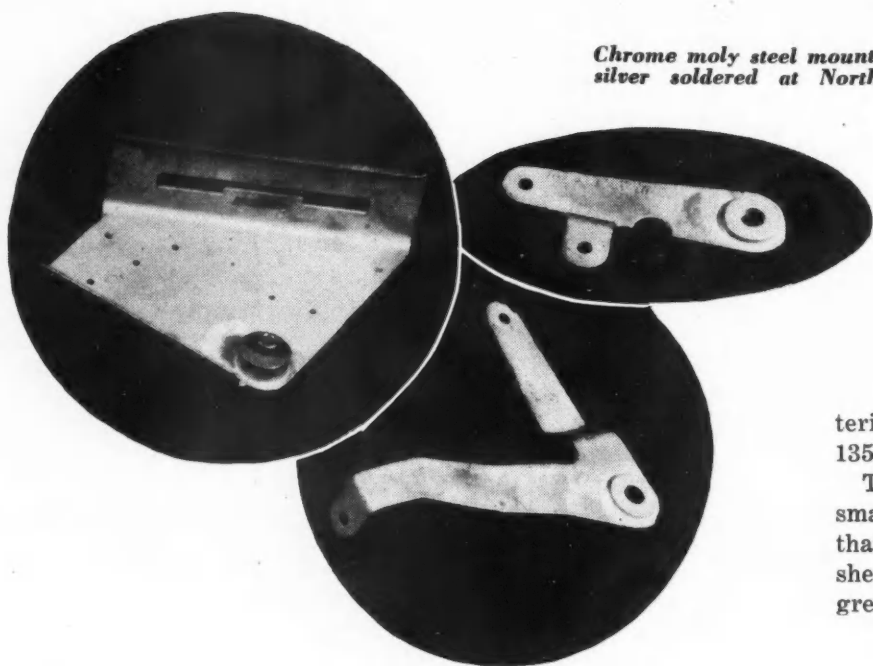
French automobile manufacturers are to be provided with funds for research and experimental work based on a tax of 0.8 per cent of the selling price of their vehicles. It is expected that for the present year the amount will be about \$1 million, but will increase as production rises.

Under the arrangement, 0.4 per cent will be given to automotive manufacturers, who will be under an obligation to make use of it for laboratory work.

The other half will be turned over to the C.E.T.A.C., a research organization already in existence, with central offices in Paris and a well equipped laboratory and staff, having originally belonged to the Automobile Club de France. This research organization is prepared to carry out any kind of work required of them by manufacturers and also undertake research work in the general interests of the industry. As an example, the laboratory is at present making

scientific examinations of German vehicles and designs and has a certain number of American Army vehicles under test.

A recent valuable acquisition to the C.E.T.A.C. is a State laboratory at Bellevue, near Paris, specially equipped for experiments in the heat treatment of metals and possessing a full sized wind tunnel. It is claimed that this tunnel, capable of receiving a full sized car, is the only one of its kind.



Chrome moly steel mounting brackets silver soldered at North American.

it has been found that as the joint is widened, the strength decreases. As for example, silver brazing alloys have a tensile strength of 45,000 to 60,000 psi. However, joints with a clearance of .001 to .003 will test over 100,000 psi and, depending on the material joined, will approach a maximum of 135,000 psi.

The reason for keeping this clearance small will be appreciated when it is realized that most of these joints are stressed in shear. If the cross section of alloy is too great, bending stresses will be set up, caus-

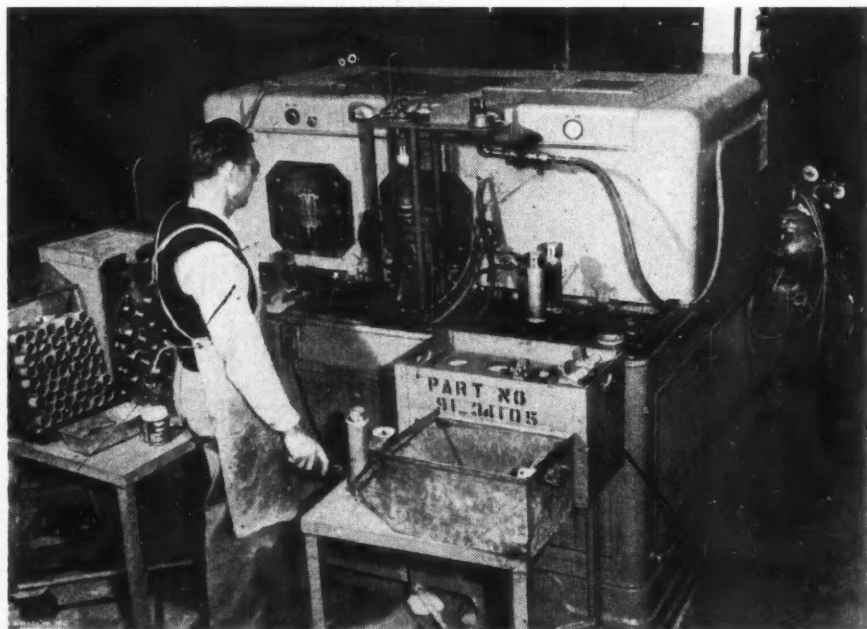
TO OBTAIN the maximum benefits from the use of silver brazing alloys, it is necessary that certain principles of design and procedure be followed. The design of the joint is largely governed by the shape of the parts to be joined. However, the selection of a lap or butt joint is controlled by such factors as ease and uniformity of preparation, the reliability of finished product and economy of operations. While it must be admitted that butt joints can be brazed and will yield strong connections, it must also be realized that this joint requires the most careful preparation. Generally speaking, the lap type of joint proves more economical for production work as tolerances can be easily met with the forming and machining operations commonly employed in shops.

Successful use of silver brazing alloys requires that clearances between the members joined be held between two to three thousandths of an inch if maximum strength is to be obtained. This fact has been determined by a large number of laboratory tests supplemented by actual field experience and

Application of High Silver Brazing and

By Herman A. Folgner

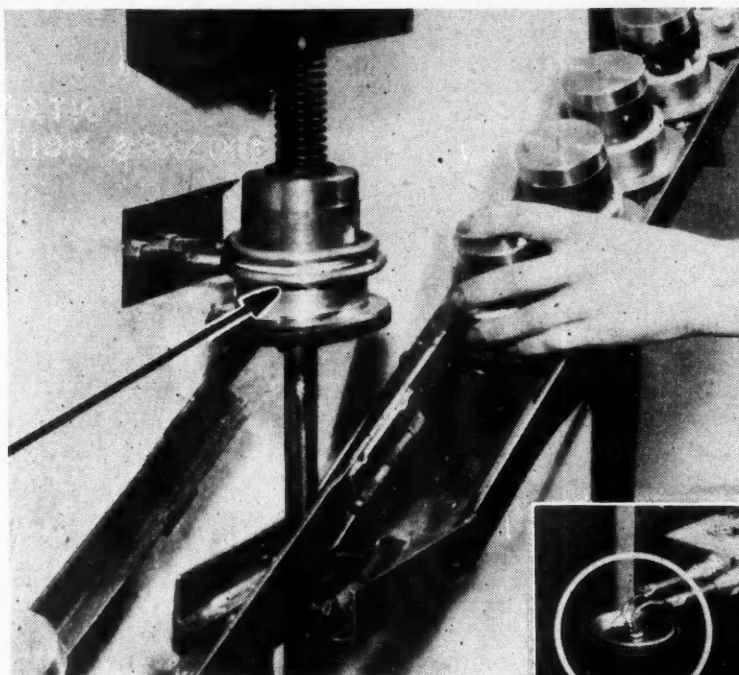
West Coast Manager,
Handy & Harmon



Motor generator induction machine setup for silver brazing hydraulic cylinder tail wheel assembly at North American Aviation plant. Note use of aligning fixture.

ing failure to occur at low values.

Silver brazing alloys, when molten, are very fluid and water like and with joint clearances of a few thousandths of an inch, capillary action causes the alloy to flow throughout the joint area in all directions. It is unnecessary, and as a matter of fact objectionable, to have large fillets which are common with other methods of metal joining. They do not add materially to the strength of the joint and certainly not in proportion to the cost.



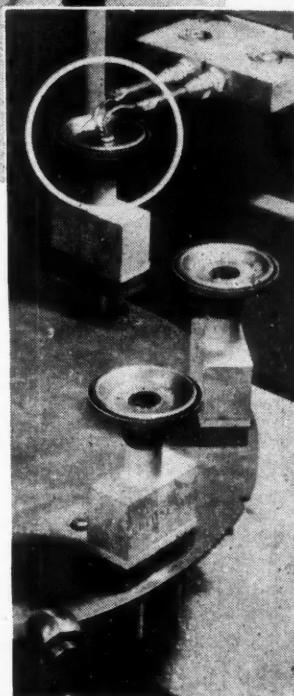
Frequency Heating to Silver Soldering

The other critical dimension in the design of brazed lap joints is the depth of lap. This is usually set at three times the thickness of the thinner member joined. In the case of dissimilar metals, it may be necessary to calculate this value. This may be done by computing the strength, either total or on a unit length basis, of the weaker member and equating it to the area of braze multiplied by the unit shear strength of the brazing alloy, using a unit shear strength of the brazing alloy of 25,000 psi, and the factor of safety.

In calculating the area in this equation, the length of joint will be known, but the depth of lap will be unknown. By solving for this unknown, the necessary depth of lap will be found. The factor of safety may be taken as between two and five, depending upon service conditions and the type of stresses involved. For low stresses and static loading, a value of two will be sufficient. Where dynamic stresses are involved, a higher value should be employed. These same figures plus the clearance of the joint will permit the calculating of the theoretical quantity of alloy necessary to make the joint.

Lap or shear type joints are more widely used in silver brazing and with tubular or round members they are particularly adapted to induction heating. They have the advantage of providing a bonding area which can be varied to meet specific requirements and a greater safety factor against breakage and leakage can be employed. Lap joints can be easily assembled

External and internal induction coil setup for silver brazing parts.



and permit greater opportunity for the support of the joint members in maintaining proper clearances.

As stated, in order to produce maximum strength of joints, a clearance of 0.001 in. to 0.003 in. is required. This is true however, only when both parts of the joint are made of metal having nearly equal co-efficient of thermal expansion. Also, it is assumed that the joint members are uniformly heated, relatively slowly. If these conditions are not met, then it is necessary to modify the 0.001 in. to 0.003 in. clearance, and the direction of change, that is, whether a greater or less clearance should be employed will depend upon the conditions involved.

Flow temperature of the silver brazing alloy to be used is one of the conditions. One which is widely used in low-temperature brazing, contains 50 per cent silver with the balance of approximately equal proportions of cadmium, copper and zinc. This alloy, known as Navy Spec. 47-5-13 Grade IV, is free flowing at 1175 F. and readily penetrates close fitting joints of ferrous and non-ferrous materials with the exception



(1) Preparing heavy steel section of an air vise for joining to a thin steel shell. A—Applying Handy-flux. B—Groove for Easy-flow.

(2) Brazing the two parts by induction heating in a pressure type jig.

(3) Finished air vise.

of aluminum and magnesium. There is another alloy of substantially the same composition, except that it contains 3 percent nickel. This alloy flows at 1270 F. and is used for the same classes of work as its lower melting counterpart. However, it finds greatest application where joints are loosely fit together and most important, in the field of carbide tool tipping and the reclamation of damaged tools. The other alloy which has been developed for use in joining the non-ferrous metals only, contains 15 per cent silver, 80 per cent copper and 5 per cent phosphorous and is free flowing at 1300 F. as per Navy Spec. 47-S-13 Grade III. These three alloys have given industry a joining medium having high strength and ductility, flowing freely at temperatures just in the visible heat range. Induction brazing permits taking full advantage of these properties.

In considering whether a greater or less clearance should be employed, let us take for example, the joining of some relatively high thermal co-efficient of expansion metal, such as a bronze bushing into a steel sleeve. On certain diameters it would be possible with even 0.003 in. clearance on a side to expand the bronze bushing upon heating, so much that the fit at the interface of the bronze and steel tube will be so tight as to prevent actual flow of the alloy into the joint. Greater initial clearance of joint is therefore necessary. If the reverse relationship of metals is employed, that is, the joining of steel tubes inside of bronze sleeves, less clearance obviously would be indicated to have good capillary clearance.

Let us assume that two tubular members of the same or similar co-efficiency of thermal expansion metals are being joined, and induction heating is employed to heat the parts. If the coil is placed around the outside member it will get hotter more rapidly than the inside member, causing the former to expand so that a silver brazed joint of intermediate strength will result. A tighter fit, even approaching as much as .005 in. interference of parts could be tolerated, depending on the diameter and flow temperature. Parts

that have a slight press-fit of the joint members have the additional advantage of serving as their own jig to keep them in proper alignment during the heating operation. Also, better heat transfer from one member to the other is possible. If the heating coil were placed inside the tube the reverse condition would develop and therefore, a greater clearance would be indicated.

A very important consideration in connection with induction brazing with silver brazing alloys closely associated with the design and fit of joints are the necessary considerations for applying the alloy. Due to the high degree of ductility and malleability of silver brazing alloys, they can be fabricated into a wide variety of sizes and shapes, thus making it possible to obtain them in the form most convenient and economical for the different conditions under which they are used. With the wide acceptance of these alloys for use in high speed, large quantity production, the use of preplaced inserts of alloys is gaining considerable favor. When tubular members and fittings are to be joined, rings can be made from rectangular strip or round wire and inserted in grooves cut in the fittings before assembling and heating. The ring inserts must be large enough to provide sufficient alloy to completely fill the joint, and allow a small excess. These rings need not always be inserted in grooves but can be placed on top of the members right at the joint. The insertion of sheet from .003 in. to .010 in. thick in thickness into the joint gives good results when joining members with lap, scarf or butt joints. Washers may be made from thin sheets and used as inserts for joining flanges, spuds and similar type fittings to tanks and other articles. While washers, when blanked from sheet are more expensive than rings, at the present time there are methods being developed for coining rings

(Turn to page 78, please)

New Production and Plant Equipment

A NEW approach to the problem of balancing connecting rods has been developed in a special-purpose machine designed and built by Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich.

Whereas previous machines have provided for two distinct operations—weighing the part, then removing it from the scale and milling it—this new set-up provides for the part being placed in the fixture and remaining there throughout the operation.

The fixture is attached to two scales which register the amount of overweight at either end of the rod. Positive end stops for the depth of the cut are adjusted by means of handwheels on which the reading is set to correspond with the readings on the two scales.

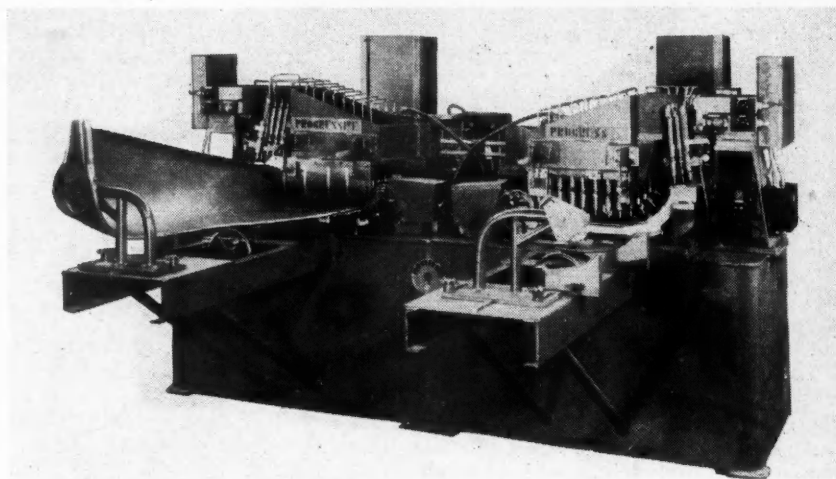
With this adjustment set, the cycle starter button is pressed and the machine goes through its cycle which is: automatically clamping the part in the fixture in fixed location, rapid advance of both milling units against their adjusted solid stops, and feeding the milling cutters through the work.

Cutters then pull away from the work and settle down to starting position. The clamps release automatically and the work piece hangs freely on the scale rods, thus giving the operator an immediate and automatic check on the accuracy of the cutting operation just completed, without the necessity of removing the connecting rod from the working position.

Chips and coolant pass through the fixture body into a coolant and chip trough in the rear of the machine. Most of the hydraulic equipment is housed within the welded steel base.

This machine was developed to take

a variety of connecting rods varying from seven to thirteen inches in length. This is achieved by making one scale



Duplex Ultra-Speed welder

movable and providing for each part a separate fixture adapter with corresponding balancing weights. Milling units are adjusted for different connecting rod lengths and for cutter wear.

Stock is milled off the connecting rod at both ends with end milling cutters and slab milling cutters, depending upon the shape of stock to be removed.

Production estimates are on the basis of an average connecting rod between the above limits and are 64 cycles an hour at 80 per cent efficiency.

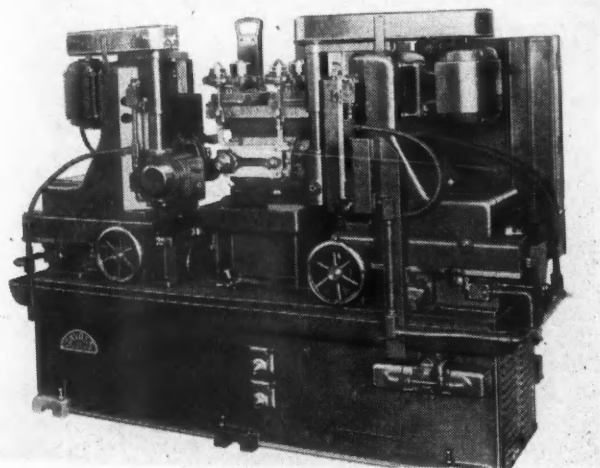
THE coordinated production of right hand and left hand fenders at 150 units per hour has been simplified by a leading manufacturer through the use

of a duplex Ultra-Speed welding machine, supplied by Progressive Welder Co., 3050 East Outer Drive, Detroit 12, Mich. The machine has two welding positions—one for left hand and one for right hand fenders. -Either position can be operated individually, or both right and left hand fenders can be welded simultaneously. Thus, two operators can maintain a continuous supply of matched fenders at the rate required by the final assembly line. In this machine the dust shields are welded to the 18 gage steel fender.

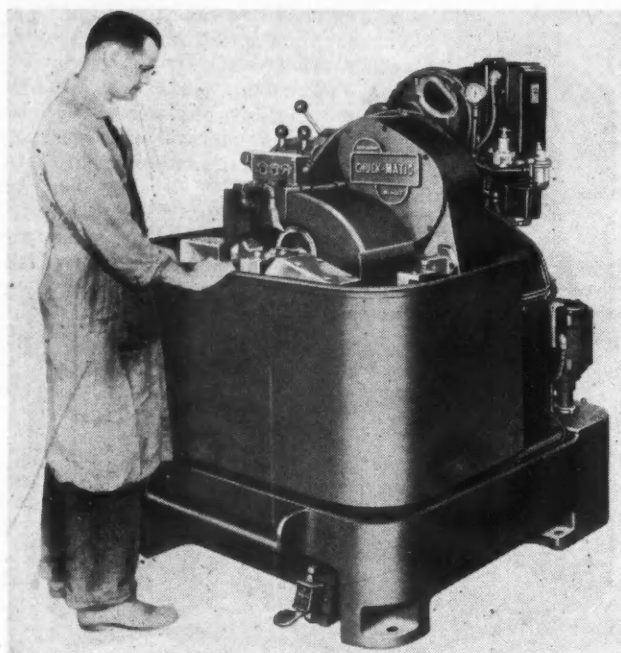
The machine is so designed to permit it to be split in two sections and the halves moved to separate locations if desired. Each side has its own welding transformer, Ultra-Speed current distribution switch, timing circuit and contactor. One hydraulic power unit furnishes welding and clamping pressure to both sides of the duplex machine. Thus only an additional hydraulic power unit need be supplied to operate the two halves individually.

Three types of welding guns are incorporated in the machine; a standard direct action type, a bell crank type to provide the greater clearance required at several points for easy loading of the parts and a floating type gun, mounted on the main table, to provide the extreme clearance required to clear the major flanges of the assembly. Both integral loading fixtures are provided with adjustable positioning arms for accurately locating the headlamp mounts, for a wide range of fender lengths.

HEAVY duty, high production machining operations on castings, forgings, and tubing parts up to 12 in. in diameter can be effectively performed on the new single-spindle automatic chucking machine designed and manufactured by the National Acme Company, 170 East 131st Street, Cleveland 8, Ohio. Named the "Chuck-Matic," this new chucker specializes in straight, internal or taper boring, form turning or form boring, external turning, form-



Snyder connecting rod balancing machine



Chuck-Matic single spindle automatic chucking machine

ing, facing and chamfering.

The air-operated "Chuck-Matic" is said to be the first single spindle chucking machine especially built to accept "all carbide" tooling. Correct surface speeds for carbide tooling can be easily selected. In addition the compact, stubby frame helps avoid tool chatter by effectively absorbing the heavy cutting pressures inherent to machining operations using carbide tools on tough alloy materials at heavy feeds and high speeds.

The "Chuck-Matic" is 64 in. long by 45 in. wide by 64 in. high. Weighing 7350 lb, the machine is built from only two major castings, the base and frame. Cutting cycles are powered by a 15 hp motor, with a 2 hp motor being used for high speed clearance movements of the toolslides.

As a means for simplifying setting-up work, only two toolslides are in use—this leaves the maximum amount of space available for loading work. With these slides a maximum boring length of 3½ in. and a turning length of 4½ in. can be obtained. End-working tools' return distance for chuck clearance is 6 in.

High and low speed cams governing the working and clearance cycles of the machine are mounted on a disc at the rear of the chucker. These cams can be changed to effect the same feed for a shorter cam rise. This feature means toolslide cams do not need to be changed for many short run jobs where setting up time is the most important factor.

Normal position of the operator is at the front of the "Chuck-Matic" at all times. The four-step operating sequence consists of (1) load work, (2) start spindle rotation, (3) allow machine to perform cutting operations automatically, (4) unload the machined work. Chuck jaws are opened and

closed by air power, controlled from a foot pedal located at the base of the machine.

A snap-lock limit switch prevents the foot pedal from operating the air control circuit to open the chuck while the spindle is in motion. When air pressure falls below an established minimum, a safety valve operates to stop all machine movements.

OPTIMUS EQUIPMENT COMPANY, 269 Church Street, Matawan, N. J., has just introduced a new continuous-type washing machine for handling large numbers of metal parts on racks, before plating, painting or any similar process. It will handle any type of parts provided they are free-draining, and the sprays have free access to the parts. The output of this machine is high—60 racks per hour being a common figure.

This new machine can be used as a single stage washer, or it can handle a number of successive operations, alkaline, acid, or neutral. With slight alterations, this machine can take care of a series of different operations—washing, rinsing, drying, pickling, cyanide treatment, etc. If an acid solution is used, the machine is furnished built of

acid-proof material. In most cases, it is desirable to use it only as a washing and rinsing machine. Its greatest use is for the cleaning of buffing compositions after buffing and before plating.

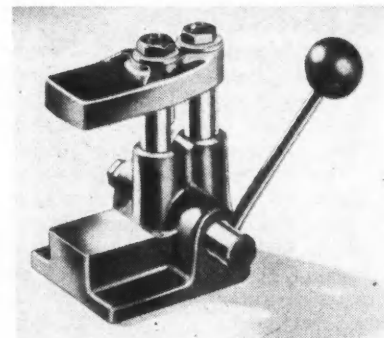
The machine works closed and may be connected to an exhaust blower so that fumes, unpleasant odors or excessive heat is not developed. It can be heated by steam, gas or electricity.

A number of manifolds with spraying nozzles are mounted on all sides of the washing chamber. Solution circulation system includes a pump, piping, series of filters and strainers to filter the solution before it is taken by the pump and all necessary heating devices and accessories.

The conveyor is an overhead chain type winding around two end sprockets driven by motor and speed reducer with variable speed pulley.

Machine is supplied entirely ready to use and may include electric panel, all switches and exhaust blower. Side insulation may be provided for comfort of the operators. Thermostatic control is available for any type of heating.

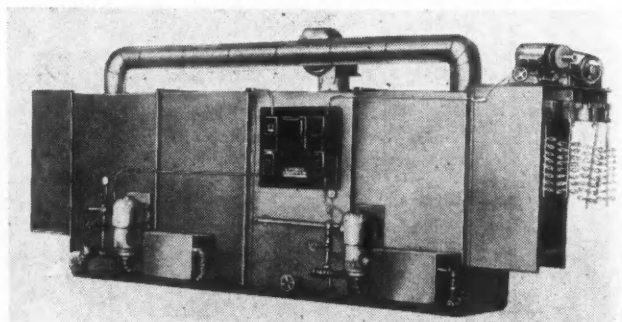
N. A. WOODWORTH Co., 1300 E. Nine Mile Rd., Detroit 20, Mich., is introducing to manufacturers its two new "Miniature" Cone-Lok jigs, which have the same Cone-Lok mechanism and



Miniature Cone-Lok jigs

the same construction as the larger sizes, with hardened and ground alloy steel working parts. Having a minimum of wearing parts, they may be assembled or dismantled in a very few moments and can be converted from right to left hand operation in two minutes, using no additional parts.

The moving parts operate in an oil

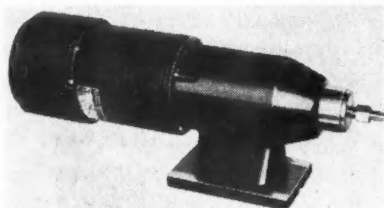


Optimus continuous-type washing machine

bath, which keeps chips and cutting oils from contact with any of the internal parts. New safety features are incorporated which provide maximum protection from accidents. No movement of working parts is possible without action of the operating lever. The tray is positively clamped at any location in up or down strokes and any sudden weight or pressure applied to the tray instantly throws the second "Cone-Lok" into action, thus securing the tray at the original position.

Two Miniature size pump jigs are now available for working spaces of 1 in. by 1 in. by 1 in. and 1 in. by 2 in. by 1 in.

GOVRO-NELSON Co., 1931 Antoinette St., Detroit 8, Mich., has developed a new centrifugal feed unit for single or multiple operation in any plane or at any angle, completely automatic with



Govro-Nelson Model K unit

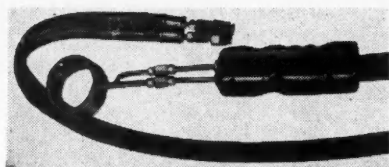
electrical controls. This Model K unit is suitable for drilling, reaming, countersinking, spotfacing, and hollow milling. With a spindle speed of 3450 rpm (full load), the range of operation is controlled by the size of tool that can be operated at this spindle speed.

The centrifugal mechanism runs in a bath of oil. Seals at the motor and spindle retain the oil and prevent entry of coolant. Slow feed for reaming or rapid movement for other operations are provided by the built-in rate of feed control. The centrifugal feed automatically compensates for dull tools or hard spots, thus protecting the tools.

USE of induction heating with somewhat the same flexibility as the soldering iron or oxy-acetylene torch is now possible by means of the flexible lead and coil set-up offered to the trade by the Induction Heating Corp., 389 Lafayette St., New York 3, N. Y.

The heating coil is mounted on a grip-type handle and is connected to a standard thermonic output transformer by specially designed flexible leads. This innovation greatly extends the scope of applications of high-frequency induction heating since it is no longer necessary to bring the work to the heating coil.

By means of flexible leads, the coil can be brought to the work so that bulky assemblies, which previously did not lend themselves to induction heating, can thus gain the advantages inherent to the use of induction heating equipment. Suitable for both heat



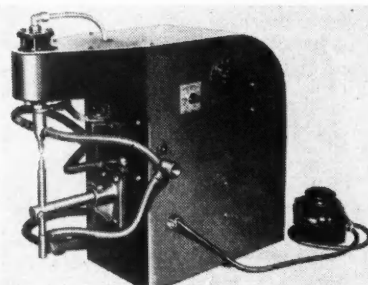
Thermonic flexible leads and coil

treating and brazing, this new coil is being used in annealing such sections as the ends of large shafts and in brazing large, tubular steel assemblies.

The heating coils used can be either single or multi-turn coils, although the single-turn inductors limit to some extent the amount of power which may be transferred into the work.

ANEWLY improved bench type spot welder is being marketed by Weldex Inc. of 7310 McDonald Ave., Detroit 10, Mich. This machine is a 3-kva, 220-volt, 60-cycle, single-phase, air-operated, foot-controlled, electronically-timed, adjustable pressure switch, precision welder. This welder, known as Weldex Model 263-A, is recommended by the maker for spot welding of light weight metals up to 18 gage C.R.S. or equivalent.

Machine measures 21 in. high, 10 in. wide and 23 in. deep, has new stream-

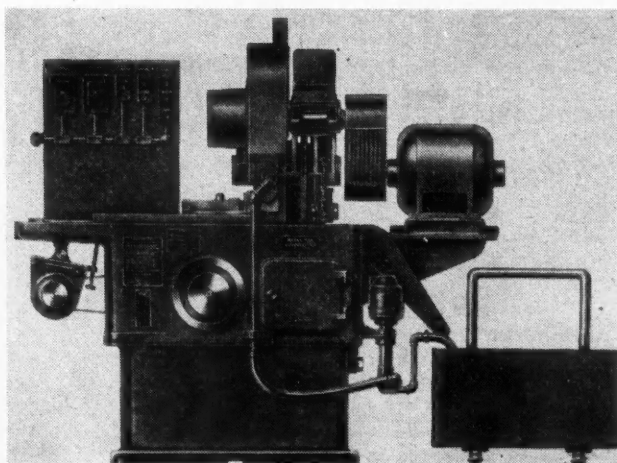


Weldex Spot Welder

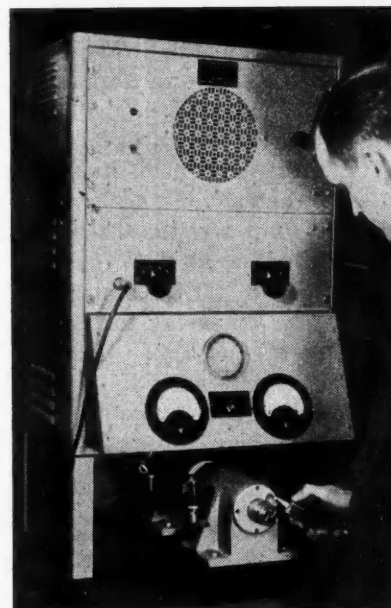
line body, air dry enamel finish and weighs approximately 135 lb when ready to ship.

This new abrasive cutting machine, made by Andrew C. Campbell Division of American Chain and Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn., cuts practically any material up to 2½ in. in diameter into lengths up to 19 in. An automatic adjustment of the down-feed of the wheel compensates for wheel wear. The oscillating head increases speed and adds to wheel life when cutting larger sizes.

Campbell No. 725 Autocutter



PRODUCTION measurement of waviness on bearing races can now be accomplished by an instrument called the Race Tester, announced by Physicists Research Co., Ann Arbor, Mich. This instrument quickly gives the average height of the waviness on ball and



Race Tester

roller bearing raceways.

The Race Tester is essentially a production instrument for use in race grinding and finishing departments. Operation consists of slipping the race to be measured on a rotating spindle, holding the converter against the raceway, and noting the meter readings. A speaker and oscilloscope are also provided for further analysis of the surface.

Two new optional features have been added to Cooley muffle type electric furnaces manufactured by the Cooley (Turn to page 85, please)

THAT Germany was particularly interested in operating economy over modern, high-speed highways, is revealed in an experimental BMW automobile seized by the French at the Stuttgart Technical Institute and brought to Paris for a close examination at the French Automobile Manufacturers' Laboratory. The car is a six cylinder of 213 cu in. piston displacement, and apparently the only one of its size built by BMW. A car of somewhat similar design, but of only 1200 cu in. displacement, won the Thousand Miles, the last race held in Europe, at the beginning of the war. It has been sought to get the best results at sustained speeds of 80 mph, but owing to the fact that synthetic rubber tires are used, the Technical Institute issued a warning against exceeding 75 mph.

Streamlining and stability at speed, the overdrive and gasoline economy, air conditioning, constant working temperature of the engine, and control of tire pressure from the driver's seat are the points which received particular attention.

The body is a compromise between the best streamlined form and seating capacity. Wind tunnel tests on models give this form a drag coefficient of 0.196, compared with 0.185 for the best of the 10 models under test and 0.501 for the worst. The reason why this car takes second place is that the rear panel is practically vertical, with a width only slightly less than the maximum of the car.

Documents seized at the institute indicate that elaborate experiments had been made with fins to secure stability at high speed. The conclusions arrived at by the German engineers were that a single fin, with or without slots, had very little effect on the stability, and might even be detrimental. To be effective, the fin must have excessive dimensions. The combination of two fins, with or without slots, was not much better. The best combination was found to be a pair of fins, practically forming a fixed keel and a rudder, which was used on the Stuttgart model. These fins were executed in plastics. A one-piece underpan is found on this car, the headlights are set into the fenders, the windshield is rounded into the side panels, and door handles, filler cap, etc., are recessed. Wheelbase is 118 in., tread 56 in. at the front and narrower at the rear, overall length 195 in., and weight with full load of passengers 4173 lb.

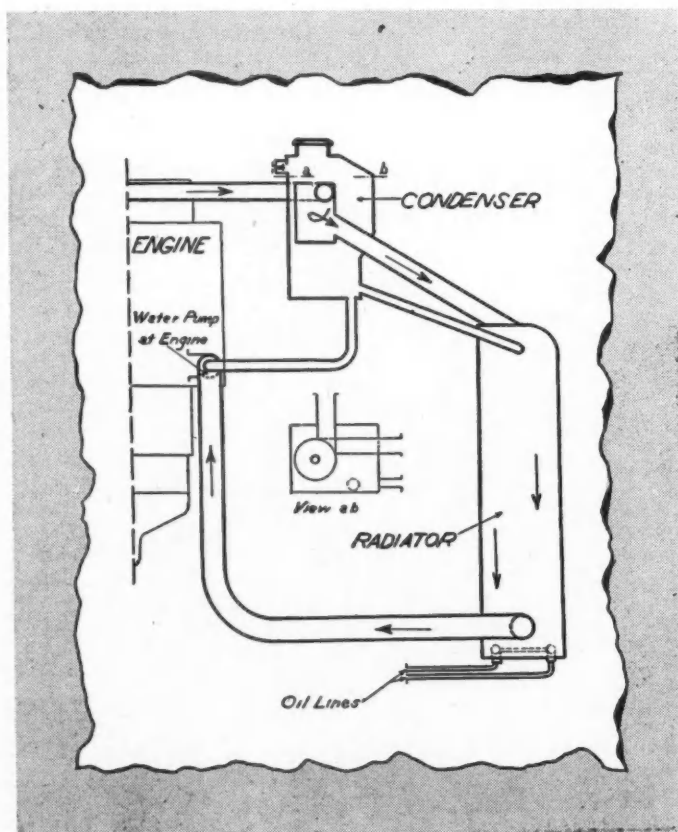
The engine is of the same general design as the stock 122 cu in. BMW, with valves in the head operated by pushrods and rockers, an unusually big air filter and a dual carburetor, the second portion coming into effect at nearly wide open throttle. The transmission provides four speeds and reverse, all being

German

*Designed for Economy
and Stability
at High Speeds*

By W. F. Bradley

Special Correspondent of
AUTOMOTIVE AND AVIATION INDUSTRIES in France



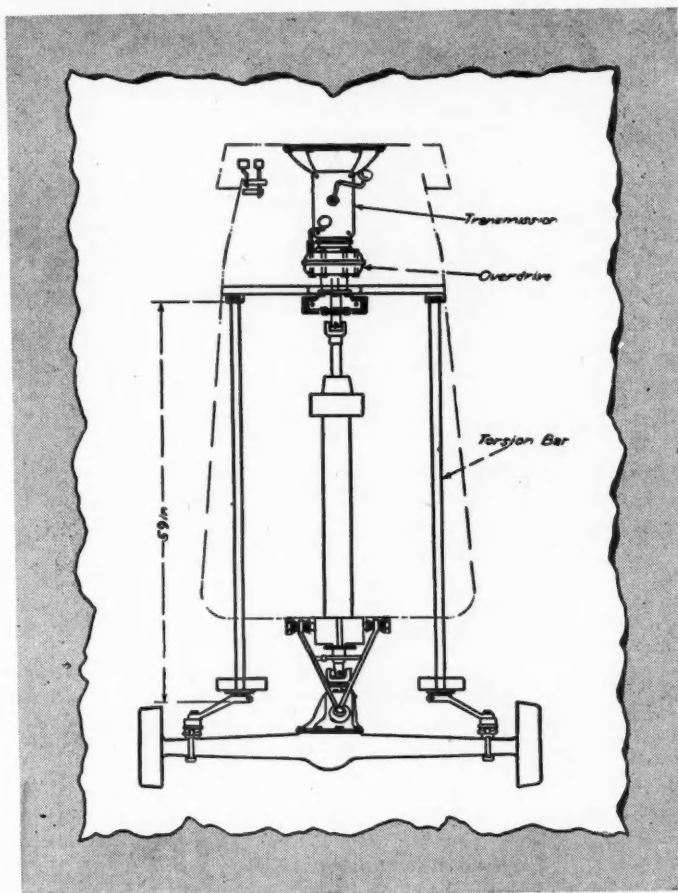
*Water cooling system of the BMW seeks
to maintain a constant working temperature*

*Drive layout of the BMW car.
Note the long torsion bars*

silent and synchronized, and in addition there is a manually operated planetary overdrive just behind the transmission. The ring gear has 84 teeth, the central fixed pinion 30 teeth, and the three satellites 26 teeth, the overdrive ratio being 1.357 to 1. The rear axle ratio is 13-38, equal to 2.923 to 1. Tire size is 6.00-16.

Independent front wheel suspension is by transverse spring and wishbone attachment and does not present any outstanding features. A rigid axle is found at the rear, the suspension system incorporating exceptionally long torsion bars, the forward ends of which are anchored at the level of the overdrive housing.

It has been sought to maintain the engine at a constant working temperature, irrespective of road and climatic conditions. The fan is ahead of the radiator, and is driven through an electro-magnetic clutch which does not come into action until a temperature of 194 F has been attained and which cuts out when the water temperature falls below 187 F. The base of the radiator is used as an oil cooler. No air passes through the radiator when starting up from

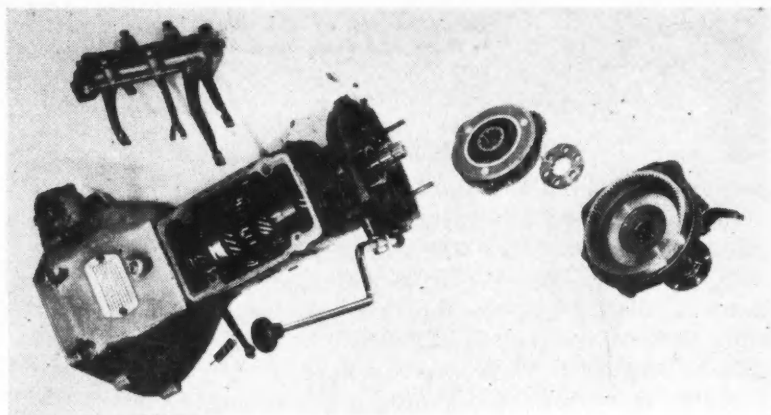


BMW Experimental Car

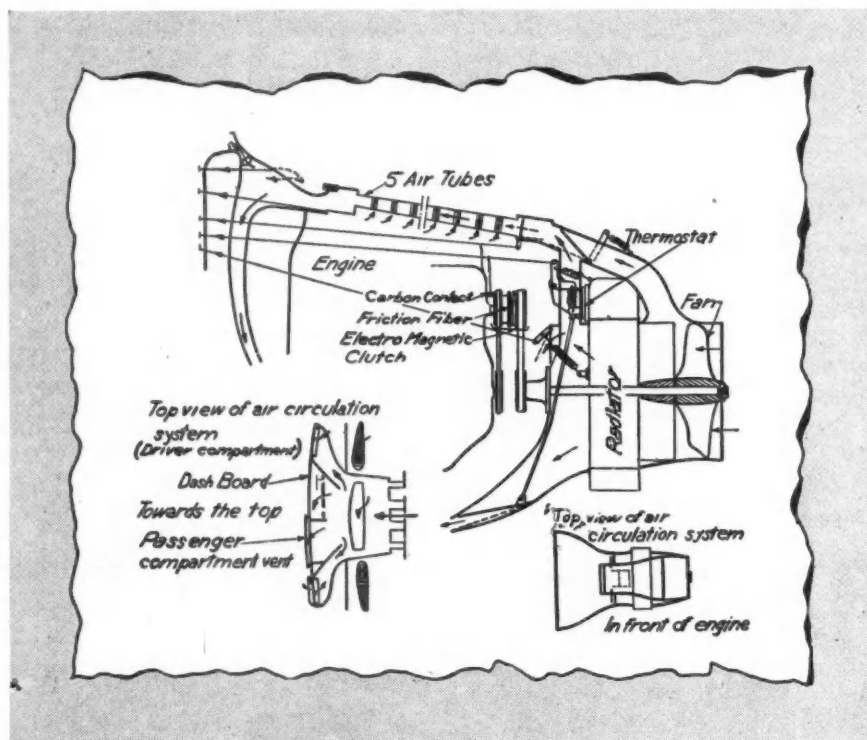
*German experimental car
tested at the French Auto-
mobile Manufacturers Lab-
oratory*



(Right) Transmission and planetary over-drive disassembled



(Below) Schematic drawing of air circulation



built-up areas, they showed the real advantage of the overdrive for fuel economy. The following are the figures obtained, and these doubtless could be much improved on over specially-built German motor highways, with few hills and no traffic obstructions:

Average Speed (mph)	Engine RPM	MPG (American Gal)
35	900	26.8
51	1300	26.3
61.5	1550	25.4
77	1950	20.4

Without the overdrive, gasoline consumption at an average speed of 46 mph was 17.8 miles to the American gallon. At an average of 50.5 mph gasoline consumption was 15.5 mpg. In all cases the total weight of the car was 4173 lb.

cold. There is a steam collector and condenser, with a return to the circulating system, and with the fan in front cold air can be directed into the body. The same pipes are used to admit hot air, when desired, this being directed to the base of the windshield or other parts of the body, where required. There is manual control for hot and cold air. This air conditioning system was used on the BMW racing car which won the Italian 1000 mile race a few weeks before the invasion of Belgium.

Another unusual feature is the power inflation, or deflation, of the tires while the car is in motion. This allows the pressure to be automatically increased to a maximum of $3\frac{1}{2}$ atmospheres, or automatically decreased to a minimum of 2 atmospheres. As certain parts are missing, this device was not tested by the French engineers in possession of the car.

Road tests prove the high degree of efficiency of the layout both from the standpoint of comfort and stability. Although the French tests had to be made on ordinary roads, including much traffic, hills, and

Piper Super Cruiser Now in Production

Production is under way on the new Piper Super Cruiser, PA-12, which is a development of the HE-1 used by the Navy as an ambulance plane during the war. The ship is manufactured under a new type certificate, however, and is claimed to be 10 mph faster than the original 100 hp cruisers built at the outset of the war. List price at Lock Haven is \$2905. The Piper Aircraft Corp. has a backlog of 5086 orders for this model. Specifications are as follows:

Wing span	35.5 ft	Rate of climb:	
Wing area	179.3 sq ft	1750 lb gross	510 fpm
Overall length	22.5 ft	1550 lb gross	620 fpm
Height	6.8 ft	Landing speed	48 mph
Weight empty	1000 lb	Take-off distance (1550 lb gross)	480 ft
Useful load	750 lb	Landing distance (1550 lb gross)	360 ft
Baggage capacity	41 lb	Cruising range	600 miles
Gas tank capacity	38 gal	Gas consumption, cruising	6.5 gph
Engine, Lycoming horizontally opposed, four cylinder, 100 hp		Absolute ceiling:	
Top speed	115 mph	1550 lb gross	17,800 ft
Cruising speed	103 mph	1750 lb gross	15,500 ft

What an Automotive Production Man Has to Say About

CRITICISMS have been voiced against the standards being established for machine tools; these on the premise that such standards will retard future development. The feeling that exists in general however, is that these standards will cause the design engineer to probe deep and to procure all details before attempting the design of a machine tool. With these standards as a guide the design engineer will know a great deal more about what is expected in the way of performance in the field.

There have been a great many changes made since the original draft and there are a few in which there might be more than a little interest. One is 2.6.2 which concerns the mounting of the control enclosure.

Control—Mounting

2.6.2. Automotive standard (in addition to 2.6.1 and instead of "recommended practice"). When enclosure is mounted on the machine, the bottom of enclosure shall be two feet or more above the floor. When separately mounted the purchaser will mount enclosure at desired height.

This originally stated that the control panel was to be at least two feet above the floor. There was some confusion as to whether this meant the panel or the enclosure. It was changed to read, that the *Enclosure* must be two feet or more above the floor. There has been plenty of controversy over this particular item which was specifically written to prevent the installation of control panels at floor height in the base of a machine. If one like that could be seen about a year after it had been in use in a cylinder block or a piston department, it would be hard to understand why it had not blown itself out on the floor. Safety of the repairman who, in order to work on an installation of that nature, is compelled to lie on the floor with his legs extending into the aisles where there is danger of being hit by material handling trucks is another reason for the change. Several instances of accidents could be cited to support this change.

Paragraph 2.6.4. now reads as follows: "All control equipment such as limit switches, brakes, solenoids, push button stations, etc., shall be mounted in a rigid, readily accessible manner in a reasonably dry and clean location free from the possibility of accidental operation by normal movement of the machine or the operator, protected so that it cannot be operated by accident, and with enough clearance from surrounding surfaces as to make removal and replacement easily possible. All limit switches shall be applied so that accidental over-travel will not damage them. Solenoids for use in oil are acceptable."

Here again an endeavor has been made to make the electrification as safe as possible for both the operator and the machine. If the wiring and the control units are kept clean and free from dirt, compounds

Machine Tool Standards

By A. P. O'Neill

Assistant Plant Engineer, Pontiac Division,
General Motors Corp.

which carry iron dust, etc., there is little likelihood of them being inoperative due to short circuits at a time when they should be operative. The last sentence: "Solenoids for use in oil" was added at the June, 1945, meeting to allow for hydraulic jobs where many solenoid valves are designed and built to operate in the hydraulic fluid without trouble.

Paragraph 3.2.3. concerns special motors.

Type of Motor

3.2.3. Automotive standard (in addition to 3.2.2) the use of the following must have purchaser's approval in writing: Ring mounted motors either vertical or horizontal; Motors with machined end plates; Shaftless motors; Gear head motors; Double shaft motors; Special length shaft motors; Any motor not a complete NEMA frame of 1940; Motors other than original NEMA frames and horsepower ratings of 1940; All other than anti-friction bearing motors; Other than separate base mounted brackets; Multi-speed motors; Short-time rated motors.

It should be easy to understand that a large industrial plant using from 10,000 to 30,000 motors must necessarily carry quite an inventory of spare motors. This would still be a very large item if nothing but standard foot mounted motors with standard dimensions were used throughout. It would be necessary to carry, for spares, at least five per cent of the total in operation. Now if only 20 per cent of the total were special motors, such as flange mounted, core fitted stators, gear head, double end shaft, special long shaft, new NEMA dimensions, sleeve bearing, motor mounted brakes, torque motors, etc., you can readily see the inventory of spares jump from five per cent to eight per cent or 10 per cent of the total in use. The

From a paper presented April 9 at the Machine Tool Forum held at Westinghouse Electric Corporation, Pittsburgh.

industrial plant is built and operated for one reason—profit, and there can be no profit from idle motors. The plant engineer and the electrical engineer do not have the time to physically check every machine that comes into the plant. So it becomes very embarrassing when some day or night a machine tool is found out of service because a little $\frac{1}{2}$ hp flange mounted motor, hidden in the base of the machine, where no one ever saw it before, is burned out and there is no spare for it. Therefore, it is suggested that the use of such special motors be approved in writing if they must be used.

There have also been lengthy arguments about paragraph 3.3.3. which governs the size of a motor compartment in a machine.

Mounting of Motor

3.3.3. Automotive standard (instead of 3.3.2) When motors are mounted inside of a machine, the motor compartment must be of sufficient size to accommodate a 60 cycle motor with terminal enclosure (original NEMA) one frame size larger than the maximum frame size recommended by the machine tool builder for driving the machine. The motor compartment must also be of such size that all motor hold-down bolts can be easily removed and replaced and terminal enclosure easily reached. Both motor end bearings on sleeve bearing motors must be arranged for checking lubricant levels, and belts must be easily replaceable. Unless the motor compartment follows these specifications, the motor must be mounted on the outside of the machine and space provided for a motor one frame size larger than the maximum horsepower recommended by the machine tool builder.

It would be interesting to see the designers, of some of the past model machines, trying to remove and replace a motor while the superintendent was fuming and fussing about the line being down. Compartments have been seen so relatively small when compared to the motor, it is not possible to believe the motor could be installed. It would be a real pleasure to see the designer trying to make and tape the connections at the motor after it is in place. What usually happens is that the wires are installed with enough length that the connections may be made out on the floor before installing the motor. This method leaves long loops of wire lying on the floor of the compartment without mechanical protection or protection from oil, water and dirt. Wires have also been seen in such installations that had slipped under the motor foot and were clamped there when the motor bolts were tightened. The consequence is shortly a ground that is very hard to locate.

The paragraph 3.3.4 was designed to protect the motor from outside influences.

Mounting of Motor

3.3.4. Motor compartments must be clean and dry and adequately vented direct to the exterior of the machine and all openings must be of such height above the floor and be protected to such an extent that dirt, chips, etc., cannot enter at such times as the floor is swept or washed or the machine is cleaned. Unless other compartments meet the requirements of the motor compartment, there shall be no openings of any kind between the motor compartment and any other compartment of the machine. If a conduit or pipe is run into the motor compartment from another compartment not meeting motor compartment requirements, any clearance around the conduit or pipe must be sealed.

It might be felt that as the enclosed motors have been standardized upon this might be an unnecessary precaution. However in practice it is very necessary. In the case of a fan-cooled motor, considerable air is

forced through the cooling ducts and naturally any dirt or oil vapors in the vicinity go with it. Soon then, the ducts are filled with dirt which makes a good blanket to keep the motor warm. All plants still have some open motors in service and some grinder builders still insist on sleeve bearings which usually means open motors, and dirt is not good for them.

In paragraph 4.2.3. the popular synthetic insulation for wires is defined.

Wiring—Type of Conductors

4.2.3. For purpose of these standards, "synthetic compound insulation" is defined as oil resistant, slow burning synthetic material such as polyvinyl compound covered by ASTM Standards #D734-43T, with a maximum operating temperature rating in air of at least 80 C for a single conductor.

During the war, some very sad experiences with some of this insulation occurred and as a result, the industry was about to condemn it entirely when it was discovered that there were a number of different grades available.

A change was made in 4.5.4.

Wiring—Reduced-Voltage Control Circuits

4.5.4. When alternating current reduced voltage control circuits are required, coils having an inrush (coil current measured with the magnet blocked open) current exceeding 20 amperes shall be energized through a relay connected in the reduced voltage circuit.

Originally the maximum size solenoid allowed without the use of a relay was specified in pounds pull. As there is interest only in the volume of current passing through the contacts of the activating medium, this was changed to a current rating.

4.6.3. on liquid tight flexible conduit and fittings.

Wiring—Conduit and Raceways

4.6.3. Automotive standard (instead of 4.6.2) Liquid-tight flexible conduit and fittings shall be used for connections involving small or infrequent movements. Such conduit shall consist of an oil-proof liquid-tight jacket or lining in combination with a flexible metal reinforcing tubing. The fittings shall be of metal and shall not separate from the conduit under tests as prescribed by the Underwriters' Laboratories for flexible conduit. The metal reinforcing tubing shall make good electrical contact with the fittings. Such conduit shall be so installed that liquids will tend to run off the surface instead of draining toward the fittings.

Flexible conduit has been one of the biggest contributors to the electrical maintenance man's troubles. The machine tool builder used about the only thing available; Greenfield and similar material. However, it was used in places where it was not necessary and some even completely wired the machine with it. This was bad as oil, cooling compounds, etc., seeps through the joints and then flow inside to the lowest point at which quite frequently is located some of the operating apparatus such as limit switches, push buttons, starters and etc. On three out of every 10 machines wired with this material, at least, one connection will be found which has been pulled off and the conduit frayed out. Several manufacturers are now working on the development of a strong moisture proof flexible conduit. The NMTBA Committee has a good knowledge of what has been done along that line.

It has been found that many of the machine tool builders are recognizing these factors and making an effort to profit by the experience that has been gained

(Turn to page 92, please)

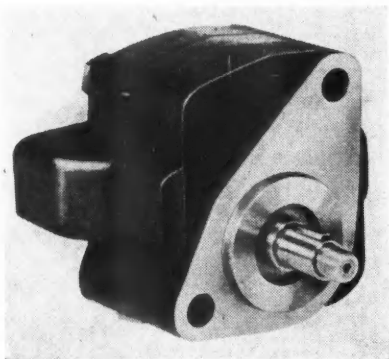
New Products

Gear-Type Pump for Hydraulic Systems

A new gear type hydraulic pump, Model H657-A, is announced by The Aro Equipment Corp., Bryan, Ohio. The unit delivers pressure up to 2000 psi with 5½ gpm 2800 rpm. Volumetric efficiency using S.A.E. No. 10 oil is above 90 per cent. Overall efficiency above 500 psi is 85 per cent or better.

The pump is suitable for hydraulic systems ranging from 100 to 2000 psi, such as farm tractor equipment actuation and control, hydraulic presses, machine tool feed controls, hydraulic jacks, bulldozer blade control, road machinery control, and other uses.

Simplified construction and high efficiency are claimed for the pump,



Aro model H657-A hydraulic pump

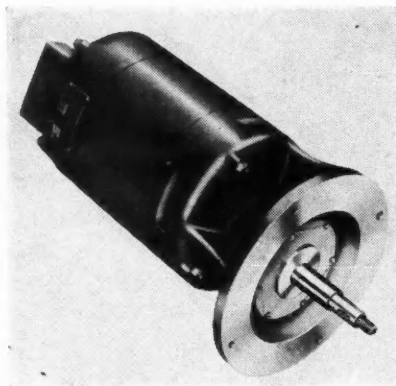
which employs Nitralloy gears in a cast iron body of "sandwich" design. It provides ample porting to standard pipe sizes, and mounting flange adaptable to users' equipment.

The unit is approximately a 3½ in. cube, with ½ in. dia by 11/16 in. drive shaft extension, plus threaded portion for ¾ in. nut.

Industrial Gear-Motor

A new gear-motor developed by the Electrical Engineering and Manufacturing Corp., 4606 W. Jefferson Blvd., Los Angeles, Cal., indicates how aircraft engineering principles can be applied to the advancement of industrial electrical equipment. The motor was developed for an application where space was limited and where 5 hp had to be delivered at 8000 rpm, using commercially available 3-phase, 60-cycle, 220-volt power.

EEMCO designed and built for the application a special, fan-cooled, open-



EEMCO gear-motor

type, two-pole, 3600-rpm motor, with output speed stepped up to 8000 rpm by a single set of helical gears in a sealed gear box. This motor is smaller, lighter, and more compact than the conventional ungeared motor. The same design, with changed gear specifications, will fit a variety of applications requiring output speeds not ordinarily obtainable with commercial current.

Unique New Plastic Announced by du Pont

An industrial plastic that is said to withstand acids which dissolve gold and platinum and to retain its strength and form at higher temperatures than any known organic material has been disclosed by E. I. du Pont de Nemours and Co., Wilmington, Del. No sub-

stance has been found which will dissolve or even swell the polymer.

It is already contributing to developments such as the jet engine, in which it is the only plastic that will stand up under the high temperatures to which it is subjected.

Duo-Servo Parking Brake For Trucks and Buses

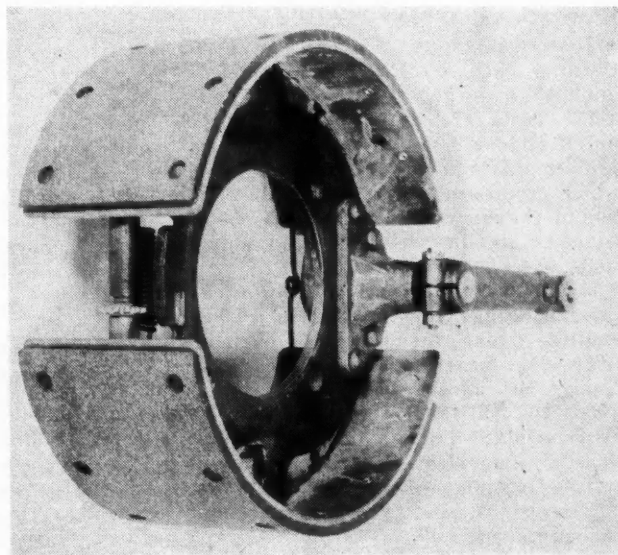
A new type emergency and parking brake for trucks and buses has recently been put into production at the Bendix Products Division, Bendix Aviation Corp., at South Bend, Ind.

Especially designed for heavy loads and high speeds, the new brake is a mechanically operated duo-servo type of construction for use on drive shaft or propeller shaft installation.

The outstanding feature of the new construction is that it eliminates the conventional backing plate which ordinarily serves as the supporting member for the brake shoes and other working parts. In the new design, the brake shoes are supported on a centrally located spider member. In addition, the anchor which takes the reaction of the braking force is mounted in the spider. In this way, the cantilever loading of the anchor pin, which tends to deflect the backing plate in the conventional brake, is eliminated. The new brake is called a "Centermount" type because of the central location of the supporting member.

The shoe action of the brake illustrated is of the familiar Bendix duo-servo principle. The primary shoe is self-energizing and at the same time exerts a servo action on the secondary shoe. The result is a brake of maximum effectiveness with minimum force required for application.

Adjustment to compensate for lining wear is accomplished by operating the star wheel shown in the illustration. As a propeller shaft brake on buses, the "Centermount" spider is usually bolted to the transmission case. The



Bendix mechanically actuated Duo-Servo parking brake

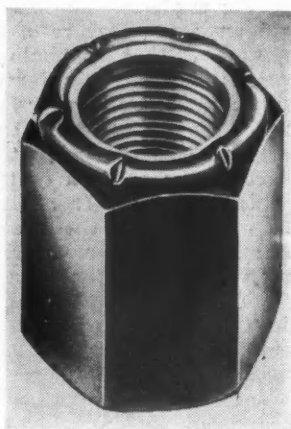
brake drum in turn is mounted on the flange of the propeller shaft.

Said to be especially smooth and powerful in action yet light in overall weight, this new centermount parking brake used as an emergency, is rugged enough to stop heavily loaded vehicles, and as a parking brake, hold them on any grade.

Self-Locking Nut for Leaf Spring U-Bolts

A self-locking nut, designed especially for automobile leaf spring U-bolts, has been developed by Elastic Stop Nut Corporation of America, 2330 Vauxhall Rd., Union, N. J.

These nuts, identified by ESNA's red elastic collar, are of high strength



ESNA's new U-bolt nut

steel with sufficient thread length to produce bolt loadings up to 70,000 psi. Eight sizes are available, ranging from 3/8 in.-24 up to 1 in.-14.

These elastic stop nuts lock in position anywhere on a bolt or stud. Vibration, impact or stress reversal cannot disturb position setting and the nuts protect permanently against vibration, corrosion, thread damage, and liquid seepage.

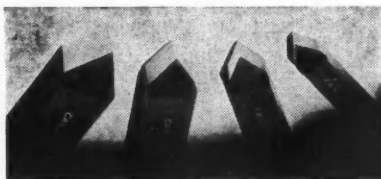
New Dow Corning Silicone Product Prevents Foaming

DC Antifoam A, a product of Dow Corning Corp., 592 Saginaw Rd., Midland, Mich., is now commercially available. Tests are said to have proved its effectiveness in eliminating foaming problems as difficult to control as those which occur during the steam distillation or vacuum concentration of various aqueous alkaline solutions and emulsions.

It is effective in very low concentrations ranging from 1 part in 10,000 against strong foamers to 1 part in 1,000,000 against weak foamers. Among the solutions and emulsions in which DC Antifoam A is effective are: alkaline black liquor, rosin soap solutions, sodium oleate and sodium alkyl sulfate solutions, Aerosol OT, cutting oil emulsions, and various synthetic rubber latices.

Carboloy Brings Out Standard Threading Tools

A new line of standard carbide-tipped threading tools—Style T-15—has been added to its standard line of tools carried in stock by Carboloy Co., Inc., Detroit, Mich. The tools are of the 60 deg. V-nose type. Tips are of Carboloy Grade 78-B, a grade of carbide particularly suitable for long run threading of steel parts.



Carboloy Style T-15 carbide-tipped threading tools

Shank sizes include 3/8 in., 1/2 in., 5/8 in., and 3/4 in. square styles. Shank lengths run from 2 1/2 in. to 4 1/2 in. Primary clearance at the nose of the tool is 3 deg., with a secondary clearance of 6 deg. This design is said to provide free cutting while insuring support for the nose of the tool tip.

Special Protective Oil

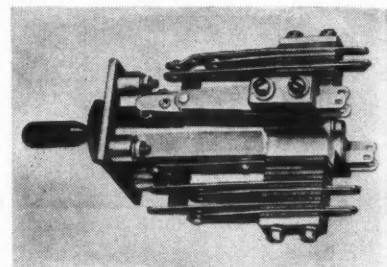
Oakite Products, Inc., 28A Thames St., New York 6, N. Y., has placed on the market a new product for the prevention of rust on ferrous surfaces between operations and while parts are in storage. Known as Oakite Special Protective Oil, it has already found use in plants where temporary or semi-permanent surface protection from rust is desired for parts or work, following such operations as grinding, machining, pickling, tumbling, sand blasting, brazing, etc.

Oakite Special Protective Oil imparts a thin, transparent, rust-preventive coating which does not interfere with accurate gaging, or stain or discolor ferrous surfaces. Parts to be rust-proofed may be immersed dry, or, because of the water displacing properties of Oakite Special Protective Oil, may be immersed immediately after cleaning and rinsing, while parts are wet, thereby eliminating the necessity for drying surfaces by a special hot rinse, air, sawdust or other methods generally used for drying prior to applying rust-preventive.

In addition, finger prints or similar marks resulting from inspection or handling of machined work in process can be removed by adding 5 per cent water to the Oakite Special Protective Oil.

Cam Lever Switch for Easy Assembly and Wiring

General Control Co., 1200 Soldiers Field Road, Boston 34, Mass., has added to its line the new Model MCF, a five-position cam-lever switch, designed especially for ease in assembly and wiring. The two features which pro-



Model MCF cam-lever switch made by General Control Co.

vide this are single hole mounting of the switch frame to the panel and single bolt assembly of the contact block to the switch frame. The single bolt assembly permits soldering of the wiring to the contacts to be done where it is most convenient, away from other units, even at a bench if desired.

The switch is locking or non-locking in all positions except the center position, which is always locking. The motion of the switch from the center to all switching positions is straight line. This, plus the positive roller action, is said to result in maximum ease of operation.

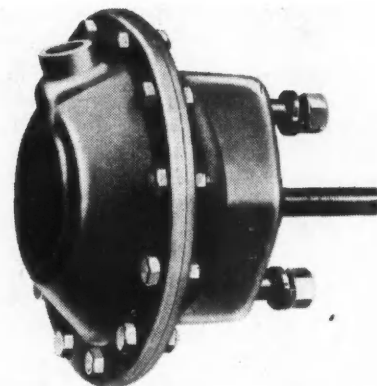
The silver contacts are permanently riveted to nickel-plated, phosphor-bronze contact springs, and all parts are non-corrosive. The contacts are rated at 10 amp, 125 volts, alternating current (non-inductive load).

The MCF is especially designed for those applications where it is imperative that only the desired circuit—of several—is closed.

Solid Nylon Sheet

E. I. du Pont de Nemours and Co., Inc., Wilmington 98, Del., has discovered (Turn to page 52, please)

Bendix Robotair



This pneumatic control, a product of Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio, has many industrial uses. It replaces other types of clamps for holding workpieces in jigs and fixtures for such operations as drilling, boring, milling, testing, etc. Pressure is applied to the device by a quarter turn of a two-way valve which may be used for a number of units. The Robotair is made in six types to suit a number of applications.



SELF-LOCKING "PLACE" BOLTS BY "NATIONAL"

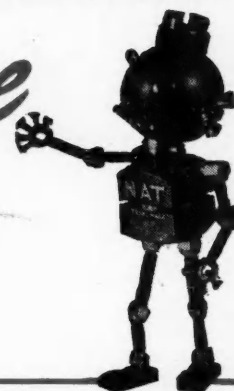
RESIST *vibration and fatigue*

This unique bolt with a "diaphragm" head design — making it elastic and self-locking — was developed for fastening tasks that must include plenty of vibration resistance.

The axial spring tension of the "Place" type bolt head, when tightened to the desired adjustment, has effectively met critical problems of fatigue and involuntary loosening on products of the automotive, aircraft, tractor and many other industries. Important examples—connecting rod bolts, main bearing cap screws, flywheel bolts and piston pin lock screws. These bolts may be used with nuts or in tapped holes

but should be used only where it is possible to tighten against a rigid seat.

Place bolts are made of alloy steel, heat-treated to high physical properties. They can be furnished in standard cap screw or other bolt dimensions, as well as in special items for specific applications. Write us for detailed information and prices.



OTHER "NATIONAL SCREW" SPECIALTIES INCLUDE:

- Clutch Head Screws
- Davis Blind Fasteners
- Drake Lock Nuts
- Dynamic Lock Nuts
- Hi-Shear Rivet Pins & Collars
- Huglock Nuts
- Laminar Flow Screws
- Lok-Thred Studs
- Marsden Lock Nuts
- Phillips Recessed Screws
- Rosán Locking System
- Scrivets
- Sems

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

closed that it is manufacturing experimental lots of a solid nylon sheeting which, because of its toughness, is expected to provide outstanding durability in leather-like applications.

This experimental development has reached the point where it is believed it will eventually open an entirely new field for nylon. The material will not be available until some production problems are solved and manufacturing facilities constructed.

Nylon is made into sheeting by being forced out through a slot on a special machine, in one continuous strip of any thickness desired. It can be made in various colors, and can be run through embossing rolls to give it any grain or other finish.

The plastic is expected to prove of special value for seat covers and panelling on trains, buses and airplanes.

Besides extreme toughness and abrasion resistance, the material is said to have good flexibility and resistance to heat and moisture. It is resistant to attacks by insects or mold.

Dual-Purpose Tire

A new type truck tire with special tread design to meet needs of vehicles that operate both on and off the highway, has been put into production by

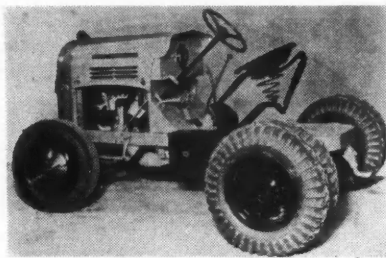


Goodyear Hi-Way Lug tire

The Goodyear Tire and Rubber Co., Akron, Ohio. Known as the Hi-Way Lug, it has a deep, non-skid and extra heavy tread plus strength in the rayon cord body to provide cut and bruise protection as well as traction and wearing qualities. The lugs are placed close together for smooth-rolling and long, even tread wear. The alternate long and short bars provide extra traction when "in the rough." Extra-heavy rayon breakers minimize shearing action between tread and carcass of the tire.

Easy-Ride Seat for Mower Tractors

For the first time since high speed grass mowers were developed, a new easy-ride hydraulically controlled seat



Worthington mower tractor with hydraulically controlled seat

has been adopted as standard equipment for a modern mower tractor.

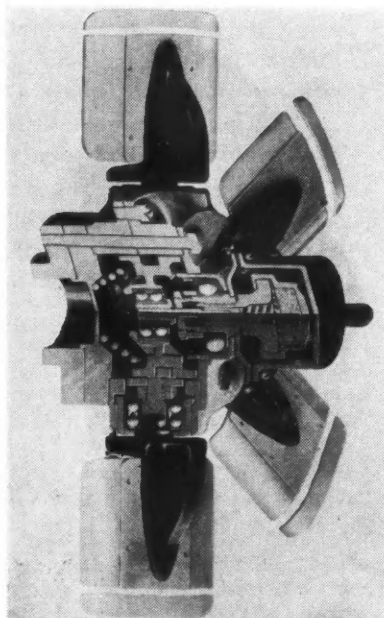
In a joint announcement, the Worthington Mower Co. of Stroudsburg, Pa., and the Monroe Auto Equipment Co. of Monroe, Mich., revealed that the new 1946 Worthington mower tractors will be equipped with the new Monroe easy-ride seat.

Engineers of the Worthington company predict that the addition of the Monroe seat to the Worthington tractor will increase the speed of large-scale mowing operations on airfields and other large areas.

New Thermo-Control Fan For Easier Installation

A front operating adapter design of the thermal power element in the Evans Thermo-Control fan has been released by the Thermo-Aire Division of Evans Products Co., 15310 Fullerton Ave., Detroit 27, Mich.

This new model has been engineered to simplify installation of the Thermo-Control fan in existing engine mounts when necessary clearances are available. To install the new model, it is only necessary to remove the old fan from the fan hub and remount the



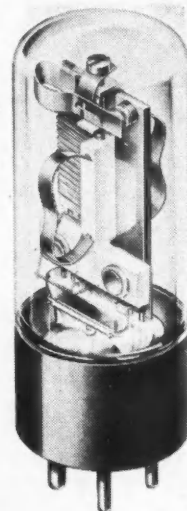
Cut-away view of Evans Thermo-Control fan

Thermo-Control fan with the correct mounting flange to fit the hub.

The Thermo-Control fan is a variable pitch self-adjusting fan operated by a built-in thermal power element. Adjusting itself to changes in engine and ambient temperature, the fan is said to maintain near constant engine operating temperature. It is manufactured in four, six and eight blade models.

Thermal Delay Relay for Heavy Current Circuits

The Instrument Division of Thomas A. Edison, Incorporated, West Orange, N. J., has brought out the Model 501



Edison model 501 thermal delay relay

thermal delay relay. This relay provides manufacturers of electronic and electric equipment with a means of delaying the control of heavy current circuits for a predetermined time interval, and also for eliminating "chatter" from delicate instrument contacts. Designed for continuous operation with its heater energized, the relay combines both time delay and control functions in one unit with no danger of false operation caused by heat from the heater affecting the ambient temperature compensation. Thus the need for an auxiliary lock-in relay to cut out the heater after it has performed its function or to handle the lead current, is eliminated. This relay offers a high ratio of controlled to controlling power and permanently accurate timing, with preset delay periods obtainable from two sec to eight min.

Basically the relay consists of a heater coil wound around a bimetal strip supporting the moving contact. The fixed contact is supported on a similar bimetal strip to maintain the same contact separation, and hence the same delay period, under widely varying ambient temperatures. Thermal insulation between the two bimetals confines the effect of the heater to the moving contact bimetal.

MORE ACCURATE HYDRAULIC PRESSURE CONTROL

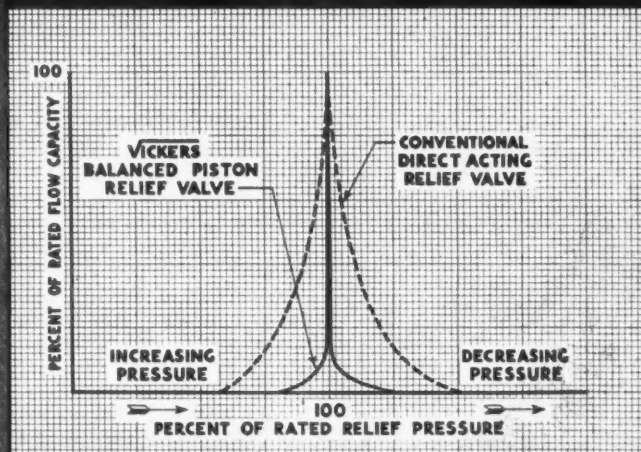
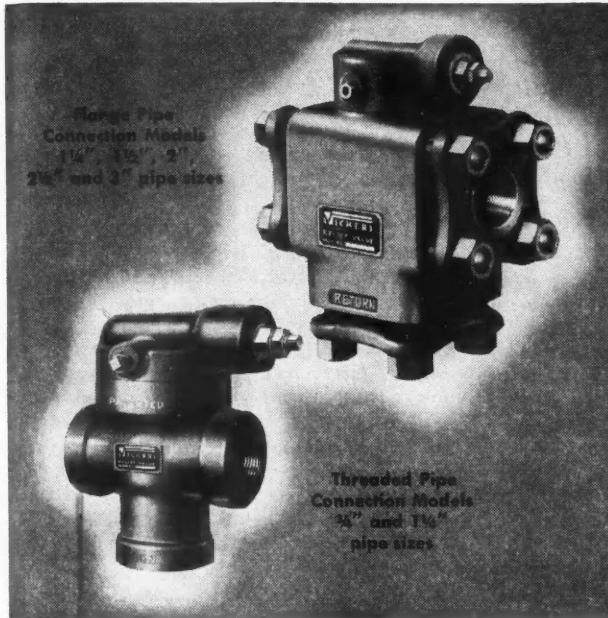


CHART SHOWS PRESSURE READINGS OBTAINED DURING A VARIATION OF FLOW RATE FROM ZERO TO MAXIMUM AND BACK TO ZERO

VICKERS Balanced Piston Type RELIEF VALVES

As indicated by the chart above, Vickers Balanced Piston Type Relief Valves have a negligible pressure variation throughout their capacity range. In these valves a hydraulically loaded and balanced piston takes the place of the customary spring-loaded direct-acting relief mechanism. This means more sensitive operation as well as greater accuracy throughout the wide pressure range.

This accuracy of control prevents pressure override when sudden changes in pressure occur in the hydraulic system. Compact design, longer operating life, installation directly in the pressure line, quiet operation, and simple adjustment are other advantages of these Vickers Balanced Piston Relief Valves. See Bulletin 38-3 for complete information.

Vickers Application Engineers will gladly discuss with you how Vickers Hydromotive Controls can be used to your advantage.

VICKERS Incorporated

1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN

Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES
NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER

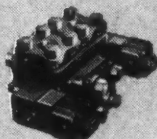
Representative of More than 5,000 Standardized Vickers Units
for Every Hydraulic Power and Control Function



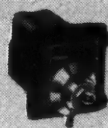
CONSTANT DELIVERY PUMPS



FLUID MOTORS



DIRECTIONAL CONTROLS



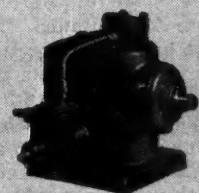
VOLUME CONTROLS



PRESSURE CONTROLS



CONTROL ASSEMBLIES



VARIABLE DELIVERY PUMPS

NEWS *of the* Industry

NINE months after the first postwar automobile rolled off the assembly line in Detroit, production is limping along at about 50 per cent of prewar output and shows no signs of hitting its goal of from five to six million cars a year for at least several months yet. At the moment the most important member of a large family of troubles is the inadequate supply of sheet and strip steel. How much the coal strike is going to affect this situation still remains to be seen, but in any event the outlook for enough sheet to meet the heavy production schedules envisioned for the months ahead is highly doubtful. Steel men say that output currently is running about 74 per cent of capacity. However, the real trouble lies not so much in the ingot capacity of the steel industry, but rather in lack of facilities to process the slabs into sheet steel. Another complication, according to industry sources, is that OPA price ceilings on certain grades of carbon sheet steel used by car manufacturers are not conducive to volume production by the mills.

Textiles and Other Materials Short

Following steel, textiles, lead, and tin also are in short supply. Here again mill capacity, competition from other industries, and OPA pricing policies are said to be the principal causes of the difficulties. Inventories of materials vary of course, between companies. Packard and General Motors, for example, are pretty well set on basic raw material inventories because they were shut down for a long period by labor trouble and have been able to accumulate stockpiles. However, their present output can be looked on only as deferred production, and in due time unless there is marked improvement, they also will be in trouble on critical items.

Parts Supplies Critical

Although there is a general belief among the public that the parts picture is pretty well under control, the truth is that it still is very much unsettled. For example, about the middle of April the number of Ford suppliers closed by strikes jumped from about 20 to 31 in one week, an increase of 50 per cent. Production at Hudson Motor and at Willys-Overland was suspended early in April for an indefinite period because of a strike at Midland Steel Products Co. And industry spokesmen say that while the labor skies over the parts industry are clearing somewhat, they expect sporadic stoppages and

**Steel Shortage Continues . . .
Tin and Textiles are Tight
. . . Parts Suppliers Still
Limping . . . Car Production
is in Second Gear . . . Ford
and Chevrolet Trending To-
ward Lower Priced Car**

nuisance interruptions to continue for at least several weeks before a continuous flow of components is assured. At present, it is next to impossible to build any adequate reserve of parts, so a stoppage in the pipeline from a single

OPA Sets Prices for New 1946 Packard Automobiles

Prices granted by OPA on new 1946 Packard automobiles average \$225 over 1942 levels. Increases over comparable 1942 models range from \$171 to \$307. Unlike most other automobile price boosts granted thus far, the Packard increase is accounted for mostly by allowance for higher wage and material costs prevailing up to last Fall. A small segment of the increase is for engineering and specification changes. The new prices, however, are considered to be interim boosts, and further upward revisions to account for recent wage increases may be announced later.

The new ceilings, together with 1942 comparisons, are as follows:

PACKARD SIX	1946	1942
Club sedan	\$1336	\$1189
4-door sedan	1408	1222
Taxi (Partition type)	1703
Taxi (Sedan type)	1599
PACKARD EIGHT		
Club sedan	1418	1231
4-door sedan	1460	1265
PACKARD DeLUXE EIGHT		
Club sedan	1469	1298
4-door sedan	1513	1331
PACKARD SUPER EIGHT		
Club sedan	1820	1619
4-door sedan	1859	1677
PACKARD CUSTOM SUPER EIGHT		
Club sedan	2381	2088
4-door sedan	2492	2185

Steel Production Rate

The operating rate of steel companies having 94 per cent of the steel capacity of the industry was 73.6 per cent of capacity for the week beginning April 22, compared with 77.4 per cent the week before, 88.5 per cent one month earlier and 93.2 per cent one year ago.

supplier of a critical part may have the effect of choking off the automobile assembly line almost immediately.

Production at Half-Way Point

Despite the many roadblocks in the path of production, the automobile industry last month reached a level approximating about one-half the weekly rate prevailing in 1941. Estimates of production for the last two weeks in April set the figure at roughly 50,000 a week. With General Motors and Packard back into production, the gain was somewhat offset by lack of production at Hudson, Willys, and Studebaker. There is a good possibility, however, that all three of these companies will be operating again early in May, and the total should climb steadily, although rather slowly. There will be no rapid climb, observers say, until the steel situation is straightened out and the labor picture clears in the parts industry.

Trend Develops Toward Cheaper Car

The announcements last month by both Ford and Chevrolet that they are actively following up plans for production of a lighter-weight, lower-cost car confirms an opinion held by many observers in Detroit that there no longer is any such thing as a low-priced car such as the industry used to sell for considerably under a thousand dollars. Many veterans in the business have watched with uneasiness the gradual embellishment of style and size in the lowest price brackets until today the delivered price is comparable to that prevailing in the medium price field a few years ago. Consequently, all brackets have moved up to a new plateau, leaving what was once the truly low-price area uninhabited. There is considerable sentiment to support the premise that past, present, and pending increases in prices have, or will, put new automobiles out of reach for a large number of buyers and that a return to the more simplified, lower-cost, lighter-weight, and less extravagantly-fitted car of former years is in order. Such automobiles would not be of the narrow tread, small body type, but would be full size with standard tread, but possibly on a shorter wheel-base. They would have smaller wheel and tire sizes, with lighter construction and a somewhat smaller engine. However, for all practical purposes, they still would be not enough different from the present conventional designs to be freakish. At least, those are the opinions of industry men today.



It has tremendous capacity for its size!

Where there's a need for high unit capacity, Torrington Needle Bearings furnish the answer to a great number of design problems...one reason also why they serve in such a wide range of applications in so many diversified industries.

Behind this outstanding advantage of tremendous radial load capacity for their size lies the principle of needle bearing design: the full complement of small diameter precision rollers which provides many linear inches of bearing contact surface...assures load distribution and minimizes wear.

There are many other Needle Bearing features important to you as designer, manufacturer or user of

mechanical equipment...ease of operation under severe conditions...ability to retain and distribute lubricant evenly over bearing surfaces...low initial cost...and unit construction permitting simple, rapid installation.

If you are not fully acquainted with all the advantages which make Torrington Needle Bearings applicable to *your* product, write for our informative Catalog 32...or for prompt assistance on immediate friction problems confronting you, consult our engineering staff.

THE TORRINGTON COMPANY
TORRINGTON, CONN. • SOUTH BEND 21, IND.
Offices in All Principal Cities

TORRINGTON NEEDLE BEARINGS

PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE AND AVIATION INDUSTRIES. In making requests give title above the item concerning the publication desired, the date of issue in which it appeared, your name and address, company connection and title.

Universal Testing Machines

Tinius Olsen Testing Machine Co.—Catalog No. 30, covering the company's entire line of Universal Testing Machines for tension, compression and flexure testing. The catalog is illustrated and includes a complete description of the principle and operation of the Olsen pendulum lever weighing system, hydraulic and electro-mechanical loading systems, testing ranges and specification details on machines in various ranges. Sections are devoted to the L Type and Lo-Cap Universal Testing Machines, electronic high-magnification recorder, proving rings and accessory tools.

Circular Form Tools

Hardinge Brothers, Inc.—Bulletin F giving features and specifications of precision ground circular form tools for automatics, chucking machines and turret lathes.

Wheelabrator Tumbblast

American Foundry Equipment Co.—Catalog No. 264 gives complete information on the 60" x 96" Tumbblast, including installation photographs, construction features, overall dimension drawings and specifications. General information and specifications on other Tumbblast models are also included.

Induction Heating and Melting

Ajax Electrothermic Corp.—New 26-page booklet, Induction Heating & Melting in Industry. The booklet is an attractive 2-color presentation, commemorating the company's 25th anniversary. It is divided into four sections, one, history and description of Induction Heating; two, Heating; three, modern melting and four, Ajax-Northrup equipment. Many illustrations of the various units and actual operations are included.

Scout Instruments

Square D. Co., Kollsman Instrument Div.—8-page descriptive folder covering new line of Scout instruments for private planes. Actual size illustrations are included of various instruments, a short description and complete type and price information.

Power-Grip Chucks

Rockford Magnetic Products Co.—New booklet, Magnetic Holding Methods, giving information on material holding. The first section contains several articles on holding problems and the second section, Catalog Section, illustrates and describes the various types of power-grip chucks.

Switches

General Control Co.—Catalog and Handbook on master switches. Descriptions and illustrations of the various

model switches are included, together with instructions for ordering and a table giving selling prices. A page is devoted to miscellaneous products manufactured by the company.

Photoelastic Stress Analysis

Eastman Kodak Co.—8-page folder covering the general photographic aspects of photoelastic stress analysis. Subjects covered briefly are optical theory, apparatus, the model, photographic materials, analysis of the records obtained and three-dimensional analysis.

Rust Preventive Oil

Oakite Products, Inc.—16-page booklet, Oakite Special Protective Oil, describes the uses and advantages of special protective oil, its characteristics, applications, etc.

Cast-To-Shape Steels

Jessop Steel Co.—A revised edition of the Cast-to-Shape Steels booklet gives information on applications to which the various tool steels are adaptable, information on patterns, heat treating instructions, etc. A temperature conversion table and a comparative Rockwell Schleroscope and Brinell hardness table are included.

Precision Microcasting

Austen Laboratories, Inc.—8-page folder describes the Microcast Process for metal industries. The origin and development of the process is covered, together with industrial advantages, range and type of microcastings and applications.

Silastic—Silicone Rubber

Dow Corning Corp.—Folder, Silastic, The Dow Corning Silicone Rubber, contains information about some of the established uses for this heat-stable, semi-inorganic rubber-like material and includes tables giving the physical, and electrical properties and the chemical resistance of the six Silastic stocks available in commercial quantities.

Advertising Notes

Sigurd S. Larmon, president of Young & Rubicam, Inc., is the new chairman of the board of the American Association of Advertising Agencies. Mr. Larmon is a member of the Council of United States Associates of the International Chamber of Commerce; director of Audience Research, Inc.; director of the Rumford Press; and director of the Scarsdale (N. Y.) National Bank & Trust Company.

Appointment by Douglas Aircraft Co. of the J. Walter Thompson Agency to handle domestic advertising and of Dorland International-Pettingell & Feh-

ton to handle foreign advertising was announced by president Donald W. Douglas.

Donald W. Meyer, president of the Truckstell Manufacturing Co., announced that Ross Roy, Inc., Detroit agency, has been appointed advertising counsel to prepare the national campaign on special equipment for trucks.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE and AVIATION INDUSTRIES

A reduced level of general business activity has been indicated. The *New York Times* index for the week ended April 6 stands at 127.3, as compared with 134.0 for the preceding week and 140.1 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended April 6 rose to a total 50 per cent above the corresponding distribution in 1945, as against a like advance of 12 per cent recorded for the final week of March. Sales in 1946 so far reported show a rise of 18 per cent from the comparable sum in 1945.

Electric power production during the week ended April 13 registered a moderate increase. The output was 7.3 per cent below the comparable amount last year, as compared with a similar recession of 7.7 per cent reported for the preceding week.

Railway freight loadings during the week ended April 6 totaled 644,663 cars, 20.3 per cent fewer than in the week before and 15.8 per cent below the corresponding number a year ago.

Crude oil production in the week ended April 13 averaged 4,691,400 barrels daily, 245,000 barrels more than the average for the preceding week but 2.5 per cent below the comparable figure in 1945.

Bituminous coal and lignite production during the week ended April 6 dropped to an estimated total of 850,000 tons, as compared with 13,270,000 tons in the last week of March and 7,716,000 tons a year ago.

Civil engineering construction volume reported for the week ended April 18 by *Engineering News-Record* is \$154,743,000, the largest weekly total since November, 1942. This amount is 30 per cent more than the figure for the preceding week and 598 per cent above that reported a year ago. The sixteen-week total shown for 1946 is 184 per cent more than the comparable sum in 1945. The increase shown for private construction is 502 per cent, and the advance in public projects is 39 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended April 6 rose to 109.1 per cent of the 1926 average, as compared with 108.7 for the preceding week and 105.1 a year ago.

Member bank reserves increased \$10,000,000 during the week ended April 10. Underlying changes thus reflected include a decline of \$90,000,000 in Reserve bank credit and a reduction of \$273,000,000 in Treasury deposits with Federal Reserve banks, accompanied by a gain of \$43,000,000 in money in circulation.

Total loans and investments of reporting member banks rose \$91,000,000 during the same week. An increase of \$54,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$7,560,000,000, shows a net increase of \$1,543,000,000 in twelve months.



IN DOUBT ABOUT YOUR LATHE EQUIPMENT?

● Maybe you've been thinking that your lathes are not putting out enough to keep higher labor and material costs in line. If they can't reduce your costs it's a sound conclusion to consider these lathes **OBSOLETE!**

Lodge and Shipley has designed engine and automatic lathes that will offset higher costs. The L & S 18, 20 and 22 inch engine lathes are revolutionary in design—entirely new and different in every part. Or consider the new 2A

and 3A Duomatics. Unskilled operators handle these automatics easily. The worker merely loads and unloads the work and starts the operation cycle. The machine does the rest.

One of these lathes may actually equal several of your older models in total output. L & S Engineers will demonstrate on your work how these lathes cut costs. Write on your company letterhead for Bulletins Nos. 500, 503, 605, (engine lathes) or Nos. 601 and 620 (for Duomatics).

THE LODGE & SHIPLEY 
MACHINE TOOL CO.
 CINCINNATI 25, OHIO, U. S. A.

MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

The Studebaker Corp., A. W. Piper, Sales Promotion Manager.

General Motors Corp., Chevrolet Light Car Div., Earles Mac Pherson, Chief Engineer; Arnold Lenz, Mfg. Manager; George A. Stout, Comptroller.

General Motors Corp., Chevrolet Motor Div., Ray C. Meddaugh, Mgr., newly created national fleet dept. J. W. Thayer and York R. F. Giddey, Asst. Mgrs. for Sales and H. M. Page, Asst. Mgr. in Chg. of Service, Engineering and Training.

Willys-Overland Motors, Inc., Arthur J. Wieland, Director of newly-created Distribution Div. of company. William E. Paris, Vice-Pres. in Chg. of the Operations Div.

Fairchild Engine and Airplane Corp., Ranger Aircraft Engines Div., Andrew L. Pomeroy, Manager of Engineering Operations.

The Glenn L. Martin Co., Richard W. Darrow, Director of Public Relations.

Borg-Warner Corp., Ingersoll Steel Div., T. L. Kennedy, Adv. Mgr. has resigned.

Menasco Mfg. Co., David B. Acker, Director of Manufacturing, and Robert A. Lawson, Asst. General Mgr.

Harry Ferguson, Inc., Fred Hunt, Director of Distribution.

The B. F. Goodrich Co., Industrial Tire & Track Div., W. D. Jones, Manager. Harry W. Roberts, Mgr., Battery and Spark Plug Sales.

The International Nickel Co., Inc., Homer W. Northrup, associated with foundry activities in the Chicago territory.

The Reliance Electric & Engineering Co., William G. Hall, Mgr., Renewal Parts and Service Div.

Wheelco Instruments Co., following have been made Vice-Presidents, Claude A. Gates, C. H. Jov, R. A. Schoenfeld, Vice-President and Director and

Charles L. Saunders, Executive Vice-President.

Lincoln Engineering Co., Jack L. Carmitchael, elected Vice-President in Charge of sales.

Elastic Stop Nut Corp., Charles E. Heintz, elected Vice-President in Charge of Sales.

Wickwire Spencer Steel Co., D. A. Sutch, General Supt., Clinton plant.

Superdraulic Corp., Harry L. Wise, President; James Hoffer, 1st Vice-Pres.; Ted Nagle, 2nd Vice-Pres.; John R. Davis, Secretary, and Robert Wise, Treasurer. Board of Directors includes the foregoing and Luke C. Leonard, Lloyd L. LaDriere and George Paul Grutis.

Carbide Die & Mold Co., George W. Frick, Executive Vice-President and Sales Director.

United States Rubber Co., Howard R. Gaetz, Supt. of Naugatuck Synthetic Rubber Plant.

Laminated Shim Co., Chairman of the Board, James A. Aborn; President, E. B. Nisbet; Executive Vice-Pres. and Treas., A. V. Anderson, and H. B. Swindells, Purchasing Agt.

Caterpillar Tractor Co., Cornell E. Jones, Sales Development Mgr.

Strainer Products Corp., Karl J. Schmaelze, Supervisor of Sales and Director of engineering applications and research.

Roy E. Cole, Vice-Pres. in Chg. of Engineering, The Studebaker Corp. has been named chairman of the technical committee for the 500-Mile Indianapolis Race.

Chevrolet Expands Iron Foundry Facilities

When expansion of facilities at the Chevrolet gray iron foundry at Saginaw, Mich., are completed working area and production will be increased about 50 per cent. Principal expansion will be in the foundry and core making departments. The expansion program has been ordered to meet the anticipated increase in demand for Chevrolet cars and trucks.

CALENDAR

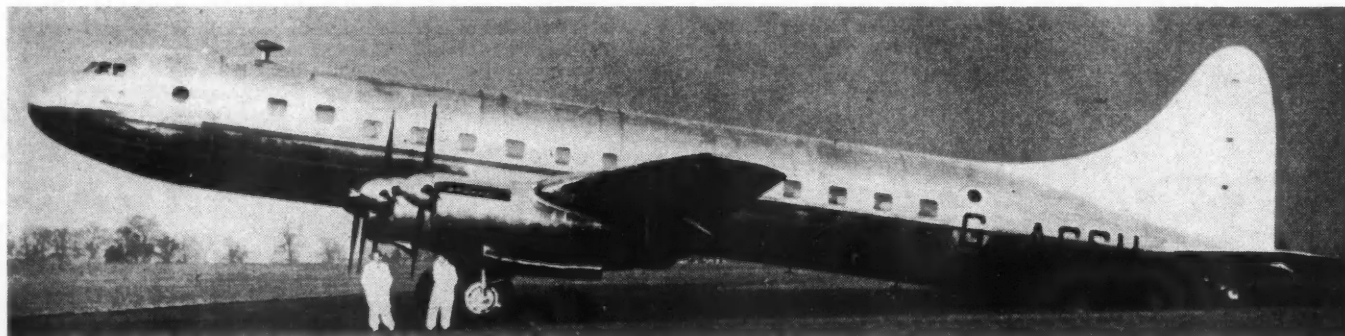
Conventions and Meetings

American Foundrymen's Assoc. Foundry Congress and Show, Cleveland, May 6-10	
Natl. Assoc. of Corrosion Engineers, Kansas City, Mo., Annual Meeting and Convention	May 7-9
Associated Business Papers, Hot Springs, Va., Spring Meeting	May 22-25
Amer. Iron & Steel Institute, New York Mtg.	May 23
Assoc. of Battery Manufacturers, Spring Mtg., Cleveland	May 22-24
Golden Jubilee, Detroit	May 29-June 9
Indianapolis Motor Speedway Race, Indianapolis	May 30
Mid-America Exposition, Cleveland	May 23-June 2
SAE Summer Meeting, French Lick, Ind.	June 2-7
Amer. Soc. of Mechanical Eng.—Detroit	June 17-20
Institute of the Aeronautical Sciences, Annual Summer Mtg., Los Angeles	July 18-19
SAE Natl. West Coast Trans. and Maint. Meeting, Seattle	Aug. 22-24
Natl. Aeronautic Assoc. of Canada, International Air Show, Toronto	Aug. 30-Sept. 7
SAE Natl. Tractor Meeting, Milwaukee, Wis.	Sept. 11-12
Instrument Society of America, 1st Natl. Show, Pittsburgh	Sept. 16-20
SAE Natl. Transportation and Maintenance Meeting, Chicago	Oct. 16-17
SAE Natl. Fuels & Lubricants Mtg., Tulsa	Nov. 7-8
American Welding Society Annual Meeting, Atlantic City	Nov. 17-22
Natl. Metal Congress and Exposition, Atlantic City	Nov. 18-22
SAE Natl. Air Transport Engineering Mtg., Chicago	Dec. 2-4
Automotive Service Industries Show, Atlantic City	Dec. 9-14

Lippard Re-Elected

Thomas R. Lippard has been re-elected president of the Federal Motor Truck Co. by the Board of Directors following the Annual Meeting of stockholders. Also re-elected were: Ferdinand L. Ruddon, vice-president; Chandler A. Rogers, secretary and treasurer; Otto J. Koski, assistant secretary and Edmund C. Dickerson, auditor.

Avro Tudor II



Britain's new Avro Tudor II designed and manufactured by A. V. Roe & Co., Ltd., is powered by four Rolls Royce Merlin engines, rated at 1670 hp, which give it a maximum speed of 325 mph at 20,500 ft. As a 60 passenger airliner the Tudor II has a range of 1850 miles at 230 mph at 20,000 ft, or with a 40 seat day installation (convertible to a 22 berth night express) its range is 2450 miles at the same speed and altitude. The wing span is 120 ft, length 105.6 ft, height 24.25 ft, and take-off gross weight is approximately 34 ton. The fuselage measures 11 ft in diameter and has a useful floor area of 574 sq ft. As a freighter the airplane has a nine ton capacity with a range of 1100 miles at 200 mph and 10,000 ft altitude.

The CONE AUTOMATIC MACHINE COMPANY



sees many

GOOD THINGS AHEAD

It is reported that

U. S. Steel's Carnegie-Illinois has patented "Stainless W", a chrome nickel steel that can be heat-hardened.

get ready with CONE for tomorrow

"Homogenization", a familiar treatment for milk, is being tried by the Marco Co. of Wilmington for its effect on metal alloys, petroleum, rayon and chemicals.

get ready with CONE for tomorrow

General Motors' engineers state that diesel engines are now so refined that they are creating a demand for special fuels with specific properties.

get ready with CONE for tomorrow

Texas Industrial Co. of Houston, Texas, has developed a radial diesel aircraft engine, from government surplus, into a power plant capable of lighting a town with 300 population.

get ready with CONE for tomorrow

Glenn L. Martin Co. and U. S. Plywood have collaborated on a construction material in the form of a sandwich. The core is a honey-comb of impregnated cloth or paper and the surfaces are of aluminum, steel, wood or plastic.

get ready with CONE for tomorrow

A relay capable of speeds up to 1,000 operations per second has been developed by Stevens-Arnold.

get ready with CONE for tomorrow

Measuring 9 inches in diameter, a new hydraulic pump made by Hydraulic Machinery Co. of Detroit is said to develop 5,000 lbs. per square inch pressure.

get ready with CONE for tomorrow

B. F. Goodrich has broken ground for a new research laboratory on a 260-acre tract between Akron and Cleveland.

DuPont reports the development of porcelain enameling on aluminum castings.

get ready with CONE for tomorrow

The world's largest concrete dam and hydro-electric plant will be built by the Chinese on the Yangtse River.

get ready with CONE for tomorrow

Victor Division of RCA is using electronic heating to seal in the metal contacts in cathode ray tubes.

get ready with CONE for tomorrow

The new Crosley automobile engine is built largely of sheet steel stampings and develops 26 h.p. with a weight of only 59 lbs.

The City of New Orleans proposes to expedite its future traffic by building a tunnel under the Mississippi.

get ready with CONE for tomorrow

The "Quantometer" is made to analyze the amounts of each element in an alloy automatically and at production-line speed. It has been developed by the Applied Research Laboratories of Glendale, California.

get ready with CONE for tomorrow

A new Westinghouse device is said to snap an X-ray picture in a millionth of a second showing imperfections in parts under stress at high speed.

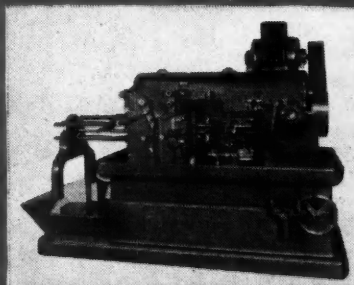
get ready with CONE for tomorrow

Peninsular Chemical Products Co. of Van Dyke, Michigan, has a new odorless, quick-drying maintenance paint that is proof against acids, alkalis and water and may be applied to wet, porous or heated surfaces.

Extra facility is extra value



This brass compression nut from 7/16" hex stock, a job ordinarily assigned to lighter duty machines, was produced by a rugged 1/4" 4-Spindle Conomatic at the rate of 4 seconds each—fifteen per minute.



Write to Cone for particulars.

Ask your CONE representative to show you our new color motion picture.

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

28

Slow Down of Britain's Automobile Industry

(Continued from page 17)

car or van (commercial cars and trucks).

The fact remains that long-term planning is impossible for the time being because the car manufacturer is not in the position to forecast his saturation point, as he can with a virile home market. Exports are imponderables. In order to budget for machine tooling, he must have a minimum quota, which is missing for new models, so he is basing his export market on modernizing 1940 styles. Capital expenditure is particularly high in these industries, so accordingly he does not feel justified in looking more than six months ahead.

In all, costs are just 100 per cent higher than 1939 figures not including purchase tax, which does not affect exports. Low output plus the increase in wages mentioned pushes up the price by 33 1/3 per cent. Rising cost of raw materials, especially alloys, adds another 40 per cent. It would seem that

the cost recovery factor swallows the rest. Standardization of models is one way to cut costs. Vauxhall is doing just this. W. G. Kendall, M. P., boasts he can produce a car for £100. It would be a six hp shorn of most of the accessories we have grown used to, but in truth, a "people's car" or utility car in the strict sense of the word.

Despite contention, Britain's exports mount. In February they totaled nearly £2½ million, which is 30 times greater than in January and twice as high as the monthly average for 1939. Morris took the lion's share of the export business, which emphasizes the upward swing of the Nuffield Group. In December it accounted for one-third of the total car exports, in January over 50 per cent.

A notable addition to the export market is the inclusion of the super class type of car, of which the 3½ liter Jaguar is a typical example. Ambassa-

dorial customers include those of Belgium, Turkey, Czechoslovakia, Iran, Yugoslavia and Chile.

The pessimist in the trade looks on the nationalization of the steel industry as a reason for expecting yet higher costs. That is as it may be, but steel unlikely will be nationalized after all. The talks are still going on as they have been since November last, the fact that no decision has been reached yet by our normally breathtaking Government makes it a safe assumption that one will not be taken.

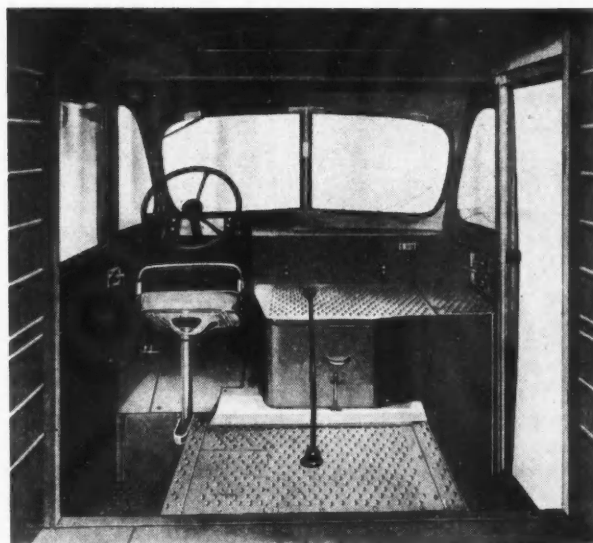
Gasoline rationing is one of the main drawbacks towards full development in this country of our production lines. Even if the cars were available, it is unlikely that the average car owner (by average, 80 per cent of our peacetime production is composed of the light car of 8-10 hp) would pay £200 to £300 for a car in which he can only

(Turn to page 62, please)

Redesigned Body on IHC Trucks



THE first 1946 light-duty trucks to be built by International Harvester Co. will be the K-1-M and K-3-M models with 113 in. wheelbase and a redesigned Metro all-steel 9½ ft body. Inside body dimensions are 70 in. (width) and 67½ in. (height), providing 280 cu ft payload space. The K-3-M chassis will be equipped with a 4-speed transmission and the K-1-M with a 3-speed transmission. Two rear axle reductions, 4.875 to 1 and 5.286 to 1, are available for the K-3-M and three axle ratios, 3.72 to 1, 4.18 to 1 and 5.11 to 1, for the K-1-M. The International Green Diamond engine of 214 cu in. displacement, developing 82.4 hp at 3400 rpm, is used on both models. The photos here show an exterior view of the K-3-M model and the interior of the driving compartment. Engine and transmission cover panels are removable for overhaul. A package compartment is provided under the roof at the front. K-1-M and K-3-M models with 102-in. wheelbase and Metro 7¾ ft body will be added to the line at a later date.

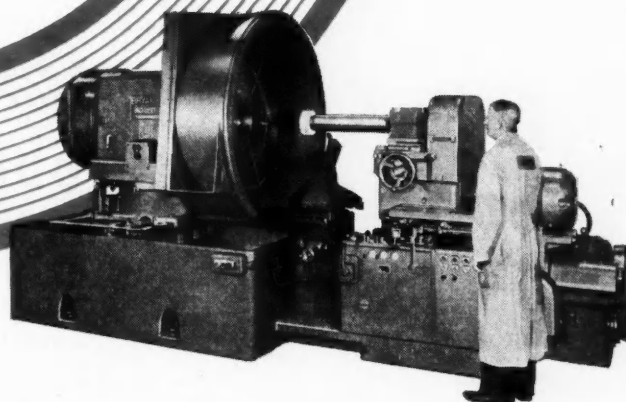


... ANNOUNCING THE NEW

No. 150

HYDRAULIC INTERNAL GRINDER

60" MAX. WORK DIA.



Another Bryant Postwar Development

The NEW Bryant No. 150 is a giant "internal grinder" with typical Bryant "fingertip" control. It retains the famous Bryant feature of three-point wheel slide suspension which is the basis of Bryant's reputation for high production of accurate work with fine finish.

The NEW Bryant No. 150 has a preloaded anti-friction cross slide, assuring smooth cross feed operation in spite of the size of the machine. Both hand and power cross feed are available and in addition, a hydraulic cylinder slides the wheel spindle to the rear to provide ample access for work loading or checking.

The work spindle is bored out to accommodate spindles or other long work which may be chucked conveniently by extension through the work spindle. The work spindle is designed so that chucks or fixtures may be mounted on either or both ends.

The NEW Bryant No. 150 will handle bore or bore & face grinding in a single chucking, and bores may be either straight or tapered. Write for a copy of the new catalog sheet which gives full details, capacities and dimensions.

If your internal grinding work comes within the range of $\frac{1}{16}$ inch diameter bore up to 60" diameter swing, it will pay you to

Send for the Man from Bryant!

BRYANT



BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

May 1, 1946

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

61

drive about 150 miles per month. There has been a lot of talk of gasoline rationing coming off, but the new books being issued carry the coupons through until Aug. 31 which, in view of the undenied statements that gasoline in this country is available, appears to be a reflection of the policy of the Government to restrict pleasure motoring and therefore pleasure-buying until the export drive has resolved itself.

Here is a summary of the current situation. Although labor is contributing its quota to high costs, their increase is being caused mainly by high

capital recovery factors devolving upon manufacturers having to recover costs on old models which they know, if the purchase tax does not come off, will not sell anyhow. Materials are up, especially some of the high duty alloy groups. Manhour output is low, six years of war making most people lethargic, but this situation is expected to improve as the servicemen return, who, it is hoped, will bring a reorientation of ideas.

The aircraft industry is in a much more healthy state. The cutback on orders for warplanes meant the closing of the shadow factories and a conse-

quent drop in numbers employed, resulting in a careful selective process that left in the industry only those who were keen to make it a career, which, from the viewpoint of industrial relations, is based on a sound psychological prognosis. Thus labor, if not satisfied with wages and conditions, is at least not openly hostile.

Most of the aircraft firms still have a nucleus of Government orders and many of them are busy on postwar planning; in fact from the production lines there is actually flowing a growing stream of postwar civil aircraft, notably among which are the Bristol 170, a version of the Wayfarer; the passenger airliner (60-seater) Tudor II from Avro; in the light airplane class are the Proctor V (Percival) and the Miles Gemini. Bristol reports that it has a two-year capacity taken up with the Wayfarer and the 170, which from pure economics indicates a trend of events that has a happy augury in this country for civil aviation.

1947 Studebaker

(Continued from page 21)

series. Champion windshield area has been increased 144 sq in.; rear window area in sedans, 239 sq in.

Body detail shows a careful regard for convenience and beauty. Outside door handles are of a new pull-to type. Interior hardware is designed for minimum protrudance. A pistol-grip parking brake is located in the center just below the dash. A new angle in the steering column promises less fatigue on long trips. Seats are fully adjustable. Rich Canda or Bedford upholstery cloth, deep cushioning and arm rests on all doors are among other features. The aircraft influence on instrument group is pronounced. At night "black light" illuminates the dials.

Standard Oil Announces Engine-Cleaning Solvents

A new product called Stano-Purge for cleaning crankcases and lubrication systems of engines and another new product named Stano-Vim for purging fuel burning systems of gasoline engines are announced by Standard Oil Co. of Indiana. Neither product is generally available yet,—but both will be soon.

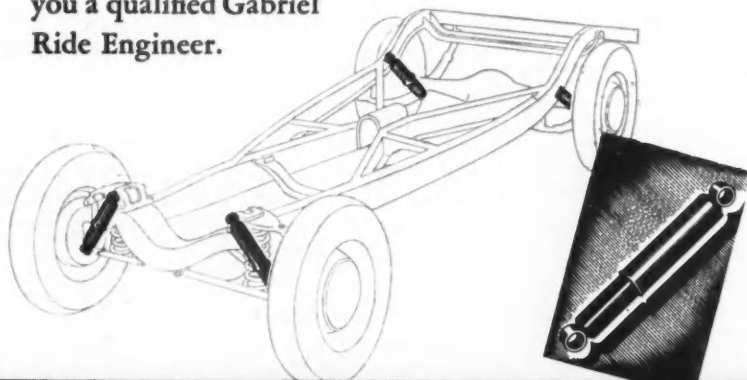
Stano-Purge is designed to remove loose crankcase sludge and clean oil screens and passages. Stano-Vim's function is to remove varnish, gum, and carbon deposits from valve stems, manifold, and intake valve parts, remove combustion chamber deposits, and clean fouled spark plugs.

Both new products are said to have high solvency for resins and gums formed by deterioration of motor oil and low volatility with high flash point—which will minimize fire hazards. Their aromatic solvents content is more than 90 per cent. They have the pronounced odor characteristic of naphthalenes.



Let's Consult *Gabriel*
on this Ride Problem...

Automotive Engineers are finding by actual experience that Gabriel Aerotype Shock Absorbers provide any required control, easy adjustment, longer life and better all around performance. If you have a shock absorber problem, a phone call or wire will bring you a qualified Gabriel Ride Engineer.



THE *Gabriel* COMPANY • CLEVELAND 6, OHIO



QUALITY CONTROL

Quality control at the source may spell the difference between profits and failure in the intense competition that lies ahead. Manufacturers may use the most efficient production methods possible but lose all the advantages by inadequate inspection facilities.

Jones & Lamson Optical Comparators provide a simple, rapid and extremely accurate means of determining the accuracy of tools and the

quality of products. Numerous models are available for the inspection of an almost unlimited range of gages, tools and products.

Our engineers are inspection specialists, their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved thousands of dollars in manufacturing plants throughout the country. Call, write or wire for their service today.

A Model for Every Job



Probably a Jones & Lamson Optical Comparator could effect comparable savings for you. Write for our book, "Beyond a Shadow of a Doubt." Or, better still, ask for one of our inspection engineers to call and discuss your inspection problems.

DID YOU KNOW...

THAT MUSICAL INSTRUMENT PARTS SUCH AS ADJUSTABLE PIVOT SCREWS, MOUTHPIECES, MOUTHPIES AND OTHER CRITICAL PARTS ARE INSPECTED ON JONES & LAMSON OPTICAL COMPARATORS.



JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U.S.A.



Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

The French Mathis Car An Underground Product

In the introductory paragraph of the article describing the Mathis French Economy Car which appeared in the April 1 issue of *AUTOMOTIVE and AVIATION INDUSTRIES*, it was stated that the car was "developed under control of German officials during the last four years in the Mathis factory." Further light thrown on the origin of this interesting vehicle shows that that statement is far from true so far as German influence is concerned.

Mr. E. C. Mathis who founded the

Mathis Co. of France and was one of that country's largest producers of automobiles before the war, has been in America for the past several years. Through the medium of the Matam Corp. of Long Island City, N. Y., which he organized and still operates, he produced war supplies for the American armed forces on a large scale and with such consistency and excellence as to win the Army-Navy E Award with five stars added.

In commenting on the article referred to, Mr. Mathis says that the Mathis French Economy Car was developed in actual defiance of the Germans. He adds, "As a matter of fact, the car is

a product of underground activities in Paris during the war to the extent that, had the Germans known about it, the engineers who were working at it piece-meal and in hiding, would have faced certain deportation, a concentration camp or, more probably, a death sentence.

"While the development work was in the designing stage, plans and drawings, of course, had to be carefully concealed, as it was considered a criminal activity. To build the prototype was another problem, cleverly solved in a small shop within the factory compound, under the very nose of the invader. The greatest difficulty was to keep the skilled mechanics from being deported to Germany, and the only way to solve this problem was to let them make their contribution to the industrial output imposed on France, so that, in their spare time at night, they could keep working for the day when France, once again, could resume her own life and rebuild her shattered economy.

"Caution, patience and luck combined brought these efforts to a successful conclusion, and the creation of these death-defying men is today ready to serve France, America and the world."

As has been previously announced, design and development work on a modified version of the French Mathis car for production in America is proceeding under the direction of Mr. Mathis.

Kaiser-Frazer Approved for AMA Membership

The Automobile Manufacturers Assn. has approved the application of Kaiser-Frazer Corp. for membership, according to George W. Mason, AMA president and president of Nash-Kelvinator Corp. The Graham-Paige Corp., of which Joseph W. Frazer, president of Kaiser-Frazer, also is president and board chairman, has been a member of AMA for several years.

Arthur Chevrolet

Arthur Chevrolet, 61, last of the three brothers who first organized the Chevrolet Motor Co., died in his home at Slidell, La., on April 16.

Louis, Gaston and Arthur Chevrolet came to the United States from Switzerland in 1900, and for some years engaged in automobile racing. When the Chevrolet Motor Co. was founded in 1911, with the aid of W. H. Little, all participated, but Louis Chevrolet was the only one among the incorporators. W. C. Durant bought the company in 1915. The brothers again engaged in racing and Gaston was killed during a race at Los Angeles in 1920. The short-lived Chevrolet Aircraft Co. was formed by Arthur and Louis in 1929. Louis died in 1941. Arthur was employed during the war by the Higgins Engine Co.



**PRECISION TO A
FINE TOLERANCE!**

**ACADIA
Synthetic**

SHEETS • EXTRUSIONS • MOLDED

Cut, molded or extruded—Acadia Synthetic Products can be processed to the closest tolerance to meet your most exacting requirements—in any shape, size or type of synthetic rubber you need.

Chemically, too, they can be compounded to match specific conditions with emphasis in varying degrees on resistance to air, light, petroleum, ozone, etc. . . . or qualities found in natural rubber—and some that are not.

Tell us the characteristics, or combination of characteristics, you need. Acadia's engineers are ready to help you work out the exact synthetic necessary.

Write us today.



ACADIA Synthetic PRODUCTS

Processors of Synthetic Rubber and Plastics • Sheets • Extrusions • Molded Parts

DIVISION WESTERN FELT WORKS

LARGEST INDEPENDENT MANUFACTURERS AND CUTTERS OF WOOL FELT

2035 41st Street, Chicago 23, Ill. Branch Offices in All Principal Cities

Aptitude Testing of Ford Workers

(Continued from page 29)

whether the applicant is skilled in such categories as arithmetic, compositions, or clerical skills. In addition, certain performance tests are now used to allow applicants such as electricians, blacksmiths, plumbers, machine operators, and many others, to demonstrate their skills as workmen. A typical test battery that is being used industrially (not necessarily at the Ford Motor Co.) for order clerks is as follows:

(1) Tests and questions designed to prove the general mental alertness of the job-applicant.

(2) A test that checks his speed and accuracy in number checking.

(3) A test designed to test his memory for numbers.

(4) A test of the applicant's basic arithmetical skill. Can he add correctly, subtract, divide and multiply? All of these skills and abilities are essential to the making of a good order clerk.

(5) A series of questions that show definitely to what degree that job-applicant is interested in a job as an order clerk.

The Ford Motor Co. found its first major use of these tests when it faced the problem of staffing its aircraft production needs with untrained men and women. The war made it necessary to employ many women for this work. By careful testing it was possible to select a high percentage of applicants who had the necessary skills and aptitudes to make good workers on these mechanical jobs. Similar success was attained in the selection of apprentices. Before the use of the selective testing techniques many young men were accepted for apprentice training who did not have the natural abilities to permit them to succeed in their work. Through selective testing the percentage of trainees who have been able to complete their training successfully has been markedly increased. In another program candidates were being selected for specific training in the field of Work Standards. Many of them were not proving successful. By the development and application of a carefully planned group of tests the percentage of successful trainees was raised appreciably. More recently the selection for potential executive personnel has proven equally successful on the basis of specially planned selective tests.

As a result of these experiences the Ford Motor Co. is expanding the use of its selective testing program to include more and more of its personnel not only in the fields of mechanical work but in the selection of its many trainees for all types of placement and advancement within the company. During the last three years over 25,000 men and women have been given such tests. At the present time men and women are being tested at the rate of more than a hundred a day.

One company official recently exem-

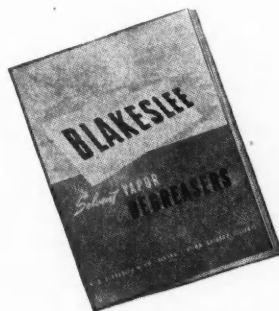
plified this progress by stating "The number of people who will be tested will increase substantially as time goes on and more test batteries are built to apply to more types of jobs." Another expresses his viewpoints in these words "These tests have proven sufficiently sound economically to justify a wider extension of their usage."

It is likely that their widespread use in industry with nearly every class of workers is only a matter of time. Naturally, with such success and such

widespread acceptance of the present values and future growth of the testing program, the question will arise "Does the testing give all the answers in all the cases?" The answer obviously is 'No, no test is perfect, no test yet devised is complete in its application.' Every test is constantly studied to determine the measure of its success. The batteries are being constantly improved both to increase their percentage of successful predictions and to find out if they can be simplified and



Write for free information booklet; your request on your company letterhead will be taken care of promptly.



With Blakeslee Degreasers you can easily clean the inside of tubing up to 40 feet long with an inside diameter as small as 1/8 inch; or precision parts of delicate instruments and watches . . . Cleaning time can be cut as much as 90% and hand scrubbing eliminated . . . The Blakeslee method automatically and thoroughly cleans all surfaces even in the pores of the metal. There's a Blakeslee degreaser to handle your specific needs.

BLAKESLEE
Solvent Vapor DEGREASERS
Metal Parts WASHERS

STANDARD
AND
SPECIALS
Engineered
for you

G. S. BLAKESLEE & CO., CICERO STATION, CHICAGO 50, ILL.
NEW YORK, N. Y. TORONTO, ONT.



**Don't throw
this back into
the Cupola!**

NEW PRODUCTION METHOD SAVES POROUS CASTINGS

This new method is particularly applicable to engine blocks and heads, valve and pump housings and other castings intended to retain liquids or air under pressure.

K&W METHOD OF RECLAIMING POROUS CASTINGS

- ... is effective on practically all metals and alloys.
- ... fits admirably into mechanized production techniques—it is fast!
- ... costs little ... often less than 20c in labor and material to recover a casting costing as much as \$15.00 at the point of rejection.

Visit booth 1210 at the
1946 Foundry Congress and Show, Cleveland, May 6-10

IMPORTANT The statements made here are taken from the daily experience of some of industry's most important production foundries.

K&W METHOD has been used successfully by the automotive industry for more than 10 years.
OF RECLAIMING POROUS CASTINGS

For further information, write

KERKLING & COMPANY

Industrial Division: 334 N. Ogden Ave., Chicago 7, Illinois
Plants: Burbank, Calif., Bloomington, Ind., and Chicago

shortened and still give the same results.

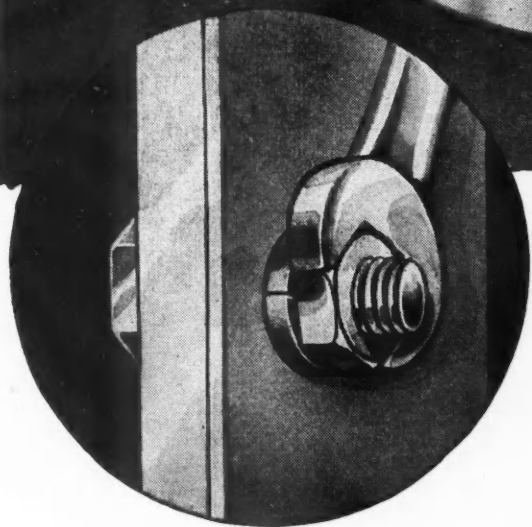
Industry is interested in raising the betting odds on the success of its selections. At the same time it is interested in reducing the cost of making these selections. By constant study and research, the future efficiency of both of these factors will be increased.

In addition to the use of tests in selecting people for specific jobs they have a wide use in planning the personal development and progress of the men after they are employed. Every person who is considered for possible training, either on his own time or on the regular training programs of the company, is carefully studied so that he may be advised as to his probabilities of success in the kind of studies that he is interested in undertaking. At present such use is made in the selection of apprentice trainees, orientation trainees, production management trainees, as well as in the selection of students who are taking less carefully planned courses for personal improvement. Veterans particularly are urged to avail themselves of the selective testing facilities so they may continue the self-improvement which many of them started while they were in the Armed Forces. Literally hundreds of workers on all types of jobs who feel that they might improve themselves are being tested to determine their potentialities for progress in the line of work they are now doing or in other lines for which they may be better suited. In every case the test results are carefully analyzed and interpreted by trained technicians.

The person who has been tested is then brought in and given a guidance interview so that he may know exactly where his best possibilities for progress and development lie. In some cases a change of jobs is indicated. In others it becomes evident that the man is in exactly the line of work for which he is best suited. In either case the man is happier and his morale is greatly increased. He is sure of his own judgment. He has a greater inclination to accept responsibilities. He has increased his industrial stature for he has the security of knowing that he can, through the aid of selective testing, plan his future more effectively. Obviously this is an increased asset to both the worker and the Ford Motor Co. All of this marks definite progress in the scientific planning for the selection, placement, and promotion of Ford employees. It shows that the motor car industry, and the Ford Motor Co. in particular, is putting science to work to better labor conditions and labor management relationships.

The past tragedy of thousands of men and women who were misfitted into jobs on which they were inefficient and which daily contributed to their own personal inefficiency is definitely being reduced. The unscientific, trouble-inviting, employment procedures are on the way out.

USE SPRING LOCK WASHERS



AS BEARINGS

For utility, economy and efficiency you can't beat a spring lock washer as a bearing. It acts as a thrust washer... prevents the assembly working loose... and at the same time is available at the lowest cost.

But there is a difference in lock washers. Try a Diamond G with Controlled Tension! Tension built right in it, and you'll know why. Diamond G Lock Washers provide positive spring tension... plus

a full surface to act as a thrust bearing. This permits full tightening of bolts or screws, safeguarding against excessive vibration, shock and wear.

Remember, for safety it's Diamond G! For quality it's Diamond G! For quick deliveries it's Diamond G! Write today for samples and the new folder giving you complete details on the new ASA and SAE specifications on spring lock washers.

GEORGE K. GARRETT CO., INC.

1421 CHESTNUT STREET, PHILADELPHIA 2, PA.
MANUFACTURERS OF



DIAMOND G PRODUCTS

LOCK WASHERS • • FLAT WASHERS • • STAMPINGS • • SPRINGS • • HOSE CLAMPS • • SNAP AND RETAINER RINGS

Trends and Developments in British Automobiles

(Continued from page 27)

stroke. The rate and degree of the fluid resistance can be set the same both ways, or can be arranged differentially. These degrees of damping are settled when this type of damper is assembled in the factory, and cannot be changed without stripping the damper.

A new feature of the Luvax-Girling damper is the recuperating chamber above and additional to that provided by the main body. This is formed by a deep cap which is spigoted into the

body and hermetically sealed by a gasket and four hold-down studs. At the base of this cap is a dished disk, having its center lipped to form a metered socket for a filler plug in the cover. The boss for the plug is continued downwards to a certain distance so as to ensure that fluid cannot be filled above a particular level, above which a cushion of air is formed in a compensation space. Fluid from this chamber percolates past the metering end of the filler plug and keeps the

main body full. If expansion resulting from heat takes place, fluid can rise back into the recuperating chamber past the metering pin, and the air in the compensation space is compressed.

This arrangement has a further purpose. If the whole body of the damper was full of fluid, and sealed up, a high-speed movement to one side would force the fluid to flow through the pressure valve on one piston, straight across, and through the return valve on the opposite piston in order to make good the cavitation on that side. On the other hand if the fluid were open to the air this quick return would not take place. The purpose, therefore, of the metering pin in the disk at the base of the recuperation and air chamber is to introduce a restriction which gives the same effect as a sealed chamber full of fluid. At the same time the fluid in the recuperation chamber can percolate past the metering pin in order to always keep the body full.

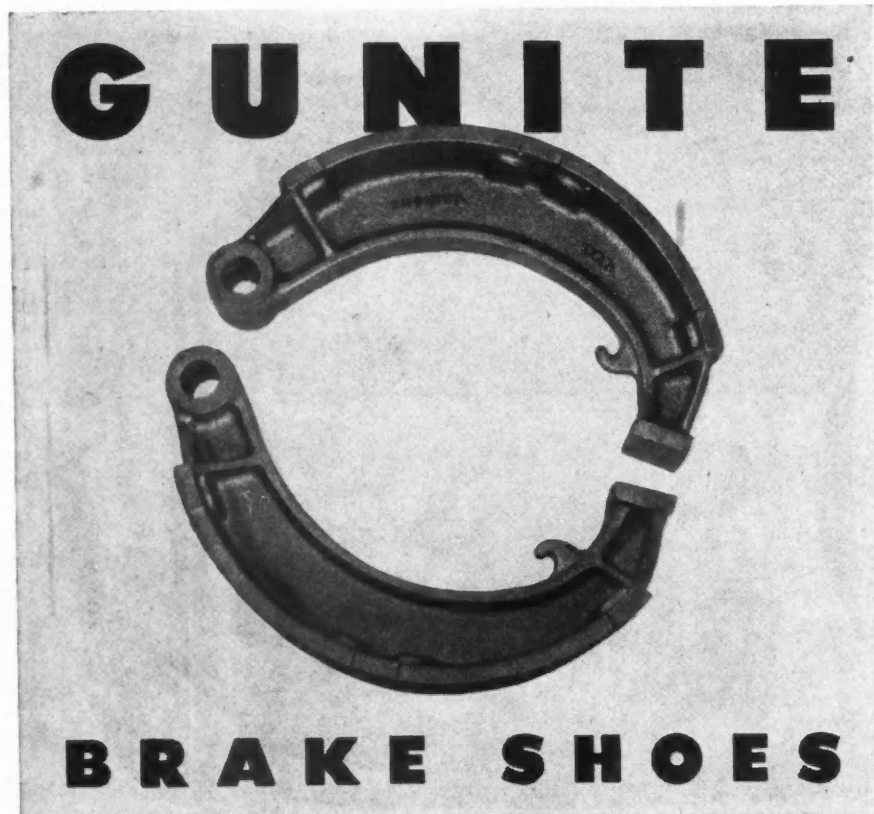
New Air Filter Design

British Filters, Ltd., has produced a cleaner capable of handling up to 671,000 cu ft of air per min, which embodies departures from previous designs. The basic principle is a simple one; it is to make air flowing through the filter pass through a venturi, which will pick up (through the medium of jets) oil from a reservoir, this oil being subsequently deposited over the filter element when the air speed drops, and finally returned to the place from whence it came at the bottom of the filter.

The niceties of the problem resided in effecting a compromise that would give adequate oil flow under all conditions of operation and at the same time prevent any part of the oil spray being carried over into the engine when operating at high airflow. A large volume of oil is picked up by the air as it passes the jets which are radially disposed around the venturi. The oil is carried up in the form of a spray to the top of the filter, where air and oil impinge on the upper part of the casing. A reverse flow then takes place, some of the oil passes straight down the annular space between the wire filter element and outer casing, and a little is deposited on the wire mesh itself. The air then rises vertically through the filter element and thus to the engine. Most of the cleaning is done by washing the air with the oil, which in this fashion picks out the bulk of the foreign bodies and deposits them in the base of the oil chamber, the wire-mesh element removing any remaining fine particles by adhesion.

As a large volume of oil can be kept in the base of the filter, servicing is but rarely required, and it is claimed that complete dismantling for cleaning

(Turn to page 74, please)



GUNITE

BRAKE SHOES



QUALITY CASTINGS MADE TO DO THE JOB

Efficient engineering and production methods with careful laboratory control — these factors combine to assure you that Gunitite Foundries castings will meet your requirements. We specialize in certain automotive items shown here — Brake Shoes, Cylinder Liners, and Brake Drums. Drums are completely finished in our own machine shop. With a backing of 90 years of experience and steady growth, we are equipped to cast ALL ferrous metals — gray iron, Gunitite, malleable, and steel — on a quality basis. *Let us quote on your requirements.*



GUNITITE CASTINGS...FOR TRUCKS, TRACTORS, TRAILERS, and BUSES

**TWO DISCS INSTEAD
OF ONE!**

**MORE BRAKE
LINING AREA**

**SIMPLER, SMALLER,
LIGHTER!**

**ESPECIALLY DESIGNED
FOR TRACTORS**

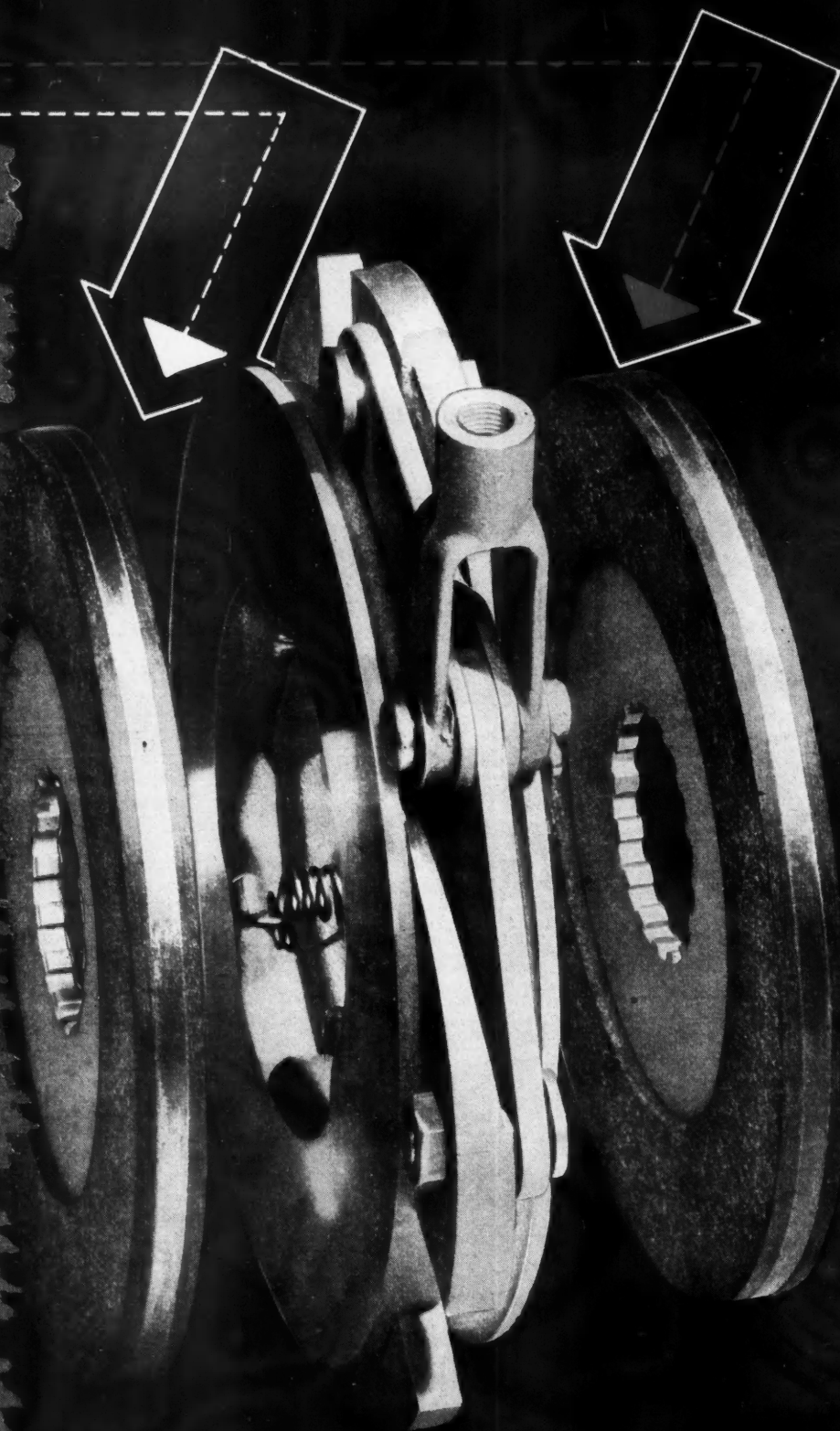
**GREATER EFFICIENCY
—MORE POWER**

**QUICKER, SIMPLER
ADJUSTMENT**

**EQUALLY EFFECTIVE
BRAKING FORWARD AND
BACKWARD MOTION**

**FEWER PARTS...EASIER
TO ASSEMBLE...ALL
INTERCHANGEABLE**

**FULLY TESTED
AND APPROVED**



(Continued from page 70)
out is only needed at intervals of 1000 hrs.

Girling Brake with Zero Clearance

A number of 1946 British cars are equipped with the new Girling Hydrastatic brake, which is in existing hydraulic brake systems, according to *The Automobile Engineer* (London). The essential difference between the Hydrastatic brake and other brake mechanisms is that the brake shoe take-off springs are omitted and in their place springs are arranged to keep the shoes at all times lightly in contact with the drums. Pressure is

exceedingly low, a few ounces is sufficient and in spite of this the shoes never leave the drums by an amount sufficient to cause audible rattle. The dashpot effect provided by the wheel cylinders in conjunction with the viscosity of the brake fluid and losses in the relatively small bore hoses checks all undesirable shoe movement.

Drag resulting from the continuous contact of the shoes with their drums appears to be almost negligible and the only special provision that has been found desirable is a slight modification of the shoes. This is to ensure that they do not rub on the leading edges when released.

Carried in two guide bushes in the master cylinder (see master cylinder layout) the working plunger projects through a "U" seal, followed by a felt washer to wipe dust off the surface as it descends. Pedal return is by a light volute spring of thin flat strip and serves to give appreciable protection to the exposed end of the plunger. A pedal is secured to the upper end of the plunger, the lower end of which passes into the working cylinder, which is a separate die casting, through a rubber seal having downwardly projecting lips. A by-pass port is drilled in the hollow end of the plunger and vents into an annular recess in the seal and communicating with the main reservoir by keyways broached in the lower guide bush.

The by-pass hole is in a moving plunger and not in a stationary cylinder, and cut off is made by the stiff base of the seal and not by the tip. Moreover, there is at all times the same pressure on both sides of the by-pass hole and therefore no tendency to force the seal into the hole and damage the rubber lip.

Owing to the long stroke of the plunger, as compared with the piston in the usual master cylinder, the by-pass hole takes up only a very small fraction of the total travel, actually $\frac{1}{8}$ in. out of $3\frac{3}{4}$ in. This factor coupled with the absence of any brake shoe clearance makes application almost instantaneous.

The working cylinder does not fit the plunger, but has an appreciable clearance. Delivery to the line is by a connection placed at the highest point, with a counterbore arranged to give plenty of area to the junction of the cylinder clearance with the crossdrilled delivery passage.

The hand brake mechanism (see illustration) is necessarily more elaborate than that frequently used with hydraulic systems. No levers or links can be allowed to be attached to the shoes on account of the danger of their upsetting the delicately adjusted idling pressure. Attached to the backplate by two bolts, one of which is in a slotted hole, is an oval flange having a bushed boss to carry the short brake camshaft. This has two arms, of which the lower is pin jointed to a push rod, slidably supported by a stud in the backplate and capable of bearing on the web of the forward shoe. The upper arm can bear direct on the machined end of the flange of the rear shoe.

A strong return spring, coiled round the bearing boss ensures that in the off position none of the operating gear touches the shoes. Connection to the hand-brake lever is by cables having diecast abutments bolted to the backplates. Rubber bellows fit on shoulders on the abutments and on to the shanks of forks swaged to the cables and pin-jointed to levers attached to the brake camshaft bearing flange, the bolts being spring loaded to permit slip.

Ingenious New Technical Methods

To Help You with Your Reconversion Problems



New Portable Grinder Lasts Longer ...Increases Production

The Portable Gaston Grinder is designed for the grinding and sanding of metal—also, with wire brushes, for paint and rust removal. Because it is powered by a 3-phase motor, without brushes, commutators or gears, the Gaston will give long service.

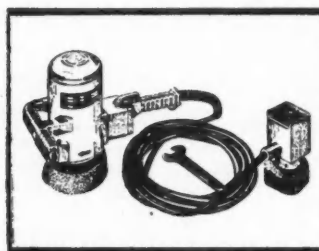
The Gaston Grinder starts at full speed. Its speed remains constant regardless of extra pressure by the operator. This controlled speed under heavy load, eliminates glazing of the grinding wheel; produces a better ground surface.

Three sizes of dust-tight Gaston Grinders are available. Furnished in either "cup-wheel" or "edge-wheel" type, as desired.

In a dusty work atmosphere, that causes throat irritation and dryness, chewing Wrigley's Spearmint Gum helps keep workers' mouths moist and fresh—thereby reducing work interruptions—and "time out" to the drinking fountain.

Workers can stay at their machine, while chewing Wrigley's Spearmint—even when their hands are busy. There is no lost time. And the pleasant chewing helps keep them alert and wide-awake. One Connecticut manufacturer with a dust problem reports group production up about 3% over normal, when workers were given chewing gum. Other plants and factories everywhere, claim stepped-up efficiency when chewing gum is made available to all.

You can get complete information from William H. Howland
2533 East 73rd Street, Chicago 49, Illinois



The Portable Gaston Grinder

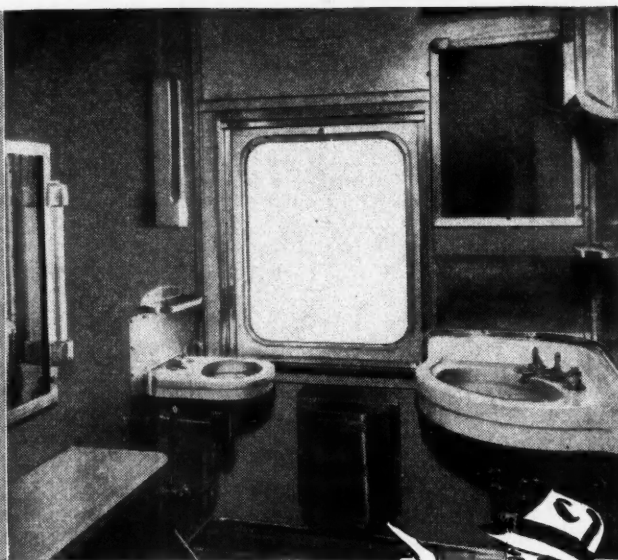


AA-68

INDEPENDENT INVESTIGATOR FINDS

*Phillips Screws
pay Pullman*

big money savings for
hundreds of driver skids eliminated!
Hold better ... look better!



Investigators from James O. Peck Co., industrial research authorities, are visiting a number of representative plants to get authentic FACTS on assembly saving. Get the "INSIDE STORY" of successful assembly practice — read his fact-filled reports!



"When we used slotted screws, we had plenty of trouble with drivers slipping and puncturing the pressed wood panels we use by the thousand for inside trim," a Pullman assembly executive told the investigator. "This meant removing and discarding the panel, replacing and

hand-painting—to the tune of several dollars per skid. Phillips Screws ended driver skids. But that's only one way they pay off.

"Where the heads show in the finish they look better. They don't have to be lined up, like slotted screws, which means they can be set up tighter to resist vibration.

"Railroads like them because they can't be loosened by passengers with coins or nail files like slotted screws—to tear clothes and cause damage claims."

REPORT TELLS MORE PHILLIPS ADVANTAGES

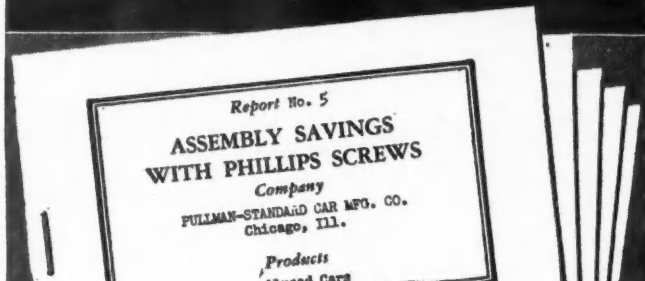
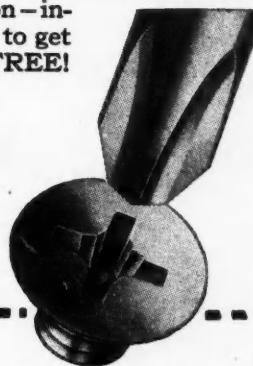
The investigator asked Pullman the same questions you would ask about assembly methods. The report tells you the complete, revealing answers.

It's one of a series of assembly studies covering all types of products—metal, plastics, wood—being made to show how the many Phillips Screw advantages add up big savings you can make in your assemblies.

The reports now ready—and more to come—comprise a practical manual of modern assembly methods—never-before-printed information—inside facts you'd pay good money to get—and you can have them, now, FREE!

PACKED WITH IDEAS FOR SAVINGS IN YOUR ASSEMBLIES

Find out how industry's top-flight assemblers licked problems like your own! Get these reports! Don't wait—fill out and mail the coupon TODAY!



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of
American Hdw. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.

26 SOURCES

Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation

Pawtucket Screw Co.
Pheoli Manufacturing Co.
Reading Screw Co.
Russell Burdall & Ward
Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Wolverine Bolt Company



U.S. INSTRUMENTS Tell The Truth

USG

PRESSURE, TEMPERATURE, FLOW, ELECTRICAL
AND LEVEL MEASURING INSTRUMENTS

UNITED STATES GAUGE

DIVISION OF AMERICAN MACHINE AND METALS, INC.
SELLERSVILLE, PENNSYLVANIA 6

6 out of 10
manufacturers of
original equipment
specify U.S.G.

WASHERS

STANDARD AND SPECIAL

Every Type
Every Material
Every Purpose
Every Finish

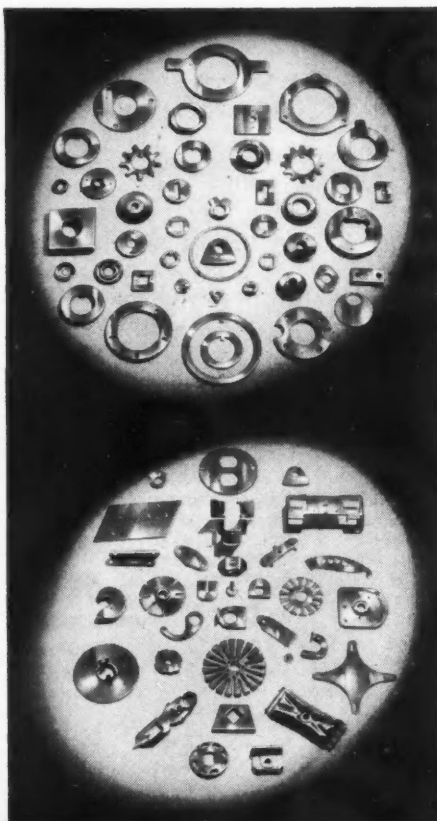
Over 22,000 Sets of Dies

STAMPINGS

OF EVERY DESCRIPTION

Blanking
Forming
Drawing
Extruding

Let us quote on
your requirements.



WROUGHT WASHER MFG. CO.
THE WORLD'S LARGEST PRODUCER OF WASHERS

2212 SOUTH BAY STREET • MILWAUKEE 7, WISCONSIN

NSPA Personnel Relations Service Announced

The National Standard Parts Association has created a completely new headquarters department under the direction of William J. Micheels, an associate professor of industrial education at the University of Minnesota, to assist automotive maintenance industry distributors and manufacturers in handling their manpower and personnel problems.

As staff consultant to NSPA, Mr. Micheels will prepare all material to be used in conjunction with a continuing broad program of personnel relations. The service, constituting one of the association's major post-war activities, will go far beyond the training of salesmen or any particular group of employees, according to C. D. McKim, NSPA executive vice-president. It will include the manufacturer's or jobber's entire organization and will deal with all subjects pertinent to employment, training and supervising of employees.

Public contact improvement is the theme of the first training course to be made available to the association's members. The first material, samples of which already have been mailed out, consists of a profusely illustrated "text" booklet for distribution to employees, and a handbook for employers. The latter explains in detail how the booklet, entitled "Let's Win Friends," may be utilized to best advantage in connection with meetings of employees. Other similar material dealing with public contacts will be issued shortly.

A second booklet in the public contact training course will deal with the highly important subject of telephone contacts. Many other phases of personnel relations will be covered in mimeographed bulletins, the first of which will be issued shortly from association headquarters.

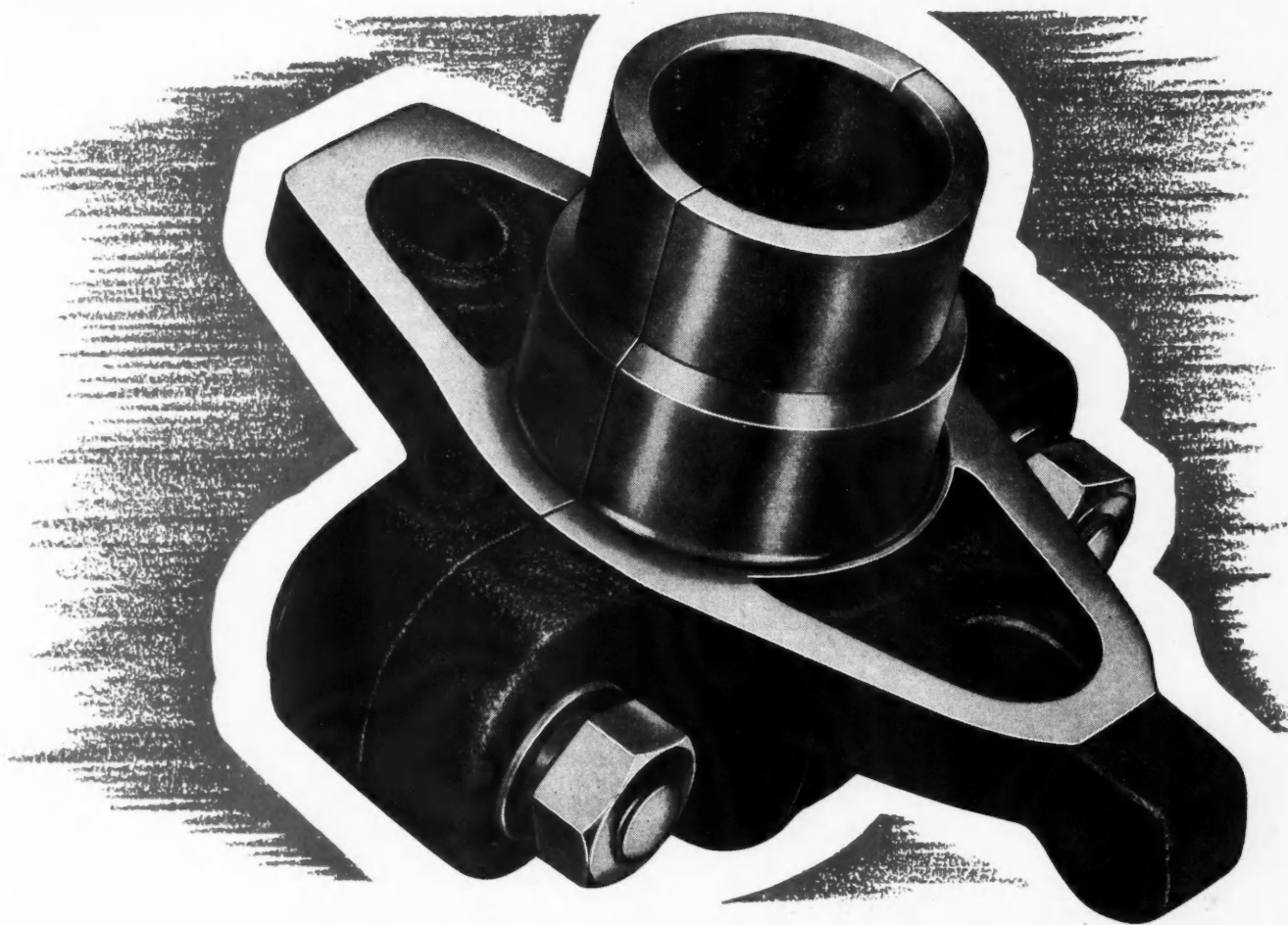
Large Attendance at Westinghouse Forum

A total of 383 representatives from 113 companies were in attendance April 9-10 at the 10th Annual Machine Tool Electrification Forum held by the Westinghouse Electric Corp. in Pittsburgh, Pa. The two sessions on the first day were devoted to electrical engineering subjects, among which were adjustable speed drives, tailored motors for rapid reversing service, circuit breakers for machine tool control, wiring methods and the standardized control transformer.

Industry reports were made on the new machine tool electrical standards, the automotive industry being represented by A. P. O'Neill, assistant plant manager of the Pontiac Division, General Motors Corp. His paper is presented elsewhere in this issue of AUTOMOTIVE and AVIATION INDUSTRIES.

Production accomplishments and sales outlook of the machine tool industry were the principal topics at the sessions on the second day.

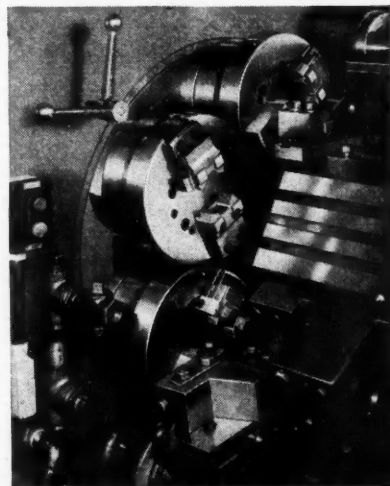
LEADERSHIP BASED ON ACCOMPLISHED FACTS...



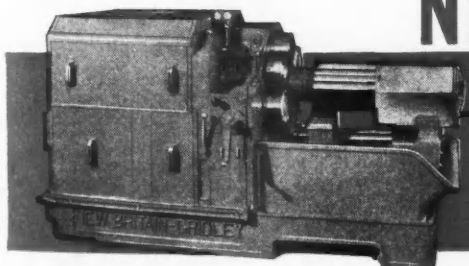
A case of machining a complete sub-assembly

Illustrated above is a malleable iron hub used in textile machinery. The two halves bolted together as shown are loaded exactly like a single piece, and our Model 16 Six Spindle Automatic Chucking Machine performs the facing, turning, chamfering and undercutting operations with a substantial saving of time and cost.

This interesting job may well suggest important possibilities in connection with your products . . . Our engineers will gladly put their time and experience at your disposal to help you discover profit-making advancement in any machining application. Consult the New Britain sales engineer in your locality or write The New Britain Machine Company.



NEW BRITAIN AUTOMATICS



THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

M-01035

May 1, 1946

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

Silver Brazing and Soldering

(Continued from page 40)

and spirally winding strip to make washers so that they will be on a more nearly equal cost basis with rings.

When induction heating is employed for making a silver brazed joint, the use of preplaced rings and inserts is almost always necessary. Fortunately there are a number of advantages to this technique such as:

(1) Control of amount of alloy used eliminates waste.

(2) Better assurance that the alloy will be properly distributed over the

joint surfaces and all parts will be wetted.

(3) The appearance of the alloy at the edge of the joint is a good indicator that the joint has been heated sufficiently to insure a good bond and this aids visual inspection.

(4) It is possible to make up assemblies having a large number of joints that can be heated at the same time.

(5) The workman can devote his entire attention to applying the heat to

the joint, the danger of overheating being minimized because the alloy melts when the proper temperature is reached.

(6) The operations of applying the alloy and heating the joint are so divided that they can be incorporated easily in straight line, high speed production.

There are other factors to be considered in the preparation of a silver-brazed joint, such as cleaning, fluxing, assembling and jiggling, heating and subsequent cleaning of the joint, and each of these factors is equally important in making a good joint. However, this discussion on the actual preparation of the joint will be confined to only the heating and, in particular, induction heating.


Assuming that a suitable source for producing high frequency electrical energy is available, it then becomes necessary to design a conductor arrangement which will give the proper heat producing magnetic field, confined to the joint area, of the parts to be brazed. The customary form of these conductors is a coil, usually hollow copper tubing to permit circulation of water for cooling, either single or multi-turn, depending on the magnetic field requirements desired for the particular application.

The important rule to remember with induction brazing, is that in making a good brazed joint, one having high strength and leak tightness, it is necessary that all surfaces to which the alloy is to adhere must be heated above the flow point of the alloy. In a sleeve type of joint it is possible to heat one surface, causing the alloy to flow and adhere to it, but not to the adjacent surfaces because it is cold, thereby chilling the alloy and thus preventing wetting. Therefore, the inductive coil should be so designed to heat the joint area of all parts as evenly and uniformly as possible.

This must not be interpreted as meaning it is not possible to conduct the heat from an outer member to an inner member. In a joint where there is a large shear area, such as a heavy collar on a thin tube, the heat can be concentrated in the outer member and the thin tube heated by conduction. This demands a tight fit between the parts as previously explained. The heating coil should be designed, concentric with the work, and cause the collar to be in a strong magnetic field and consequently be rapidly heated. The heat generated in this outer collar would then melt the preplaced brazing alloy ring and also heat the surface of the tube beneath the collar to the flow temperature of the alloy. With the correct heating pattern the alloy would flow down between the collar and tube by capillarity, completely wetting both surfaces and forming a fillet on both top and bottom. The coil should be spaced sufficiently far away from the outer surface of the collar to give a

(Turn to page 82, please)

Logan A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES



at these 39 points*
this Logan Lathe has
self-lubricating
bronze bearings

LOCATION	NO. BEARINGS
Underneath Drive	8
Reverse Gear Bracket	2
Gear Box	10
Headstock	7
Automatic Apron	6
Carriage Assembly	4
Turret Assembly	2
TOTAL	39

*All models of Logan Lathes are similarly protected.

**SELF-LUBRICATING
BRONZE BEARINGS**

**KEEP LOGAN LATHES READY TO RUN,
ADD TO SERVICE LIFE,
NEED FAR LESS OILING**

The use of self-lubricating bronze bearings in place of plain bearings is typical of Logan Lathe design. The self-lubricating bearings are of a special bronze that is absorbent in texture and impregnated with lubricant. As a shaft revolves in one of these bearings, the lubricant is gradually released in a self-controlled flow which keeps an even film of oil over contacting surfaces. In this way, even though the lubricant is only infrequently renewed, the bearing surfaces are protected. In addition, the spindle on every Logan Lathe revolves on precision preloaded ball bearings that never need lubrication. This sustained lubrication is another factor in the sustained accuracy and long life of Logan Lathes. Get the full story of the advantages offered by the complete line of Logan Lathes from your Logan Lathe dealer, or write for a catalog.

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10 1/2" . . . bed length, 43 1/8" . . . size of hole through spindle, 25/32" . . . spindle nose diameter and threads per inch, 1 1/2"-8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, 1/2 hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision-ground ways, 2 V-ways, 2 flat-ways.

J- 6

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

NEW

Totally Enclosed

TRI/CLAD MOTORS

REG. U.S. PAT. OFF.

In 1940, G.E. introduced the Tri-Clad open motor—with emphasis on the feature that industry wanted most in a motor, *protection*. Since then, more Tri-Clads have gone into service than any other integral-horse-power motor.

Today, we are ready with a new line of Tri-Clad motors—*totally enclosed, fan-cooled motors*—built on Tri-Clad design principles in both standard and explosion-proof types.

We believe that these are industry's most dependable motors. They are designed specifically for use in many adverse atmospheres—in iron dust, outdoors, in hazardous areas, and chemical atmospheres. Their scope of application is as wide as the field of industrial motor use. Safeguarded against most sources of motor damage, their longer life and lower maintenance will make them economical motors for use on almost every job. General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC



slow, soaking heat rather than a surface heat which would produce such a temperature gradient across the collar, as to cause overheating of the outer surface before the inner surface has been brought up to brazing temperature. A great number of brazing operations fall into the general classification just described, that is, when one member is heated by induction and the other member by conduction from the former.

The heat generating induction coil used for brazing can be of various designs depending on the shape of the parts to be brazed and the location of the joint. Coils can be rectangular,

circular, or spiral-helical for external heating. A flat or pancake coil is used for large flat areas. Special coils can be made for internal heating but are less efficient than an external coil.

Generally speaking, when considering induction heating for a brazing application the following points should be carefully considered:

1. Determine whether the heat should be concentrated in one piece and allowed to flow by conduction to adjacent members or whether all pieces should be heated directly by induction.

2. Design the coil so as to subject the section to be heated to a strong alternating magnetic field.

3. Allow ample spacing between the heating coil and the work. This will permit the work to be placed into and removed from the coil with the least trouble and at the same time prevent overheating of surfaces very near the coil.

4. Design the coil so that the most energy is thrown into the piece of largest heat mass, thus allowing all parts to rise in temperature at the same rate.

5. Strive for the simplest heating coil which will give the correct results.

There are many distinct advantages to the use of induction heating for silver brazing, both from the viewpoint of a practical heating method as well as permitting successful use of the silver alloy. Together they are a natural team, giving the following advantages:

SIMPLICITY OF OPERATION — The operations are extremely simple, making it possible, therefore, to use unskilled operators. It is of decided advantage to have push-button control, particularly when a great many pieces are being produced. In addition, each joint is uniform whether one hundred or one million are made.

Low Cost—While the metal silver is relatively expensive and represents a definite percentage in the various silver brazing alloys, it has been proved that the actual cost of making a silver-brazed joint is very low. The primary reason for this is the fact that so little quantity of alloy is needed to make a satisfactory joint. Furthermore, the alloy cost alone is not the only factor to consider in making a joint. The other operations such as cleaning after brazing, speed of operation, reliability, etc., are factors definitely favoring the low-temperature silver brazing alloys. The cost to operate the induction generator is very low, usually running in the neighborhood of one-half cent or less per piece heated.

High Speed—Brazing by high frequency electric induction is inherently a fast operation, particularly when using the low-temperature, fast-flowing silver brazing alloys. For large-scale production this is of definite advantage.

Control of Heat — The heating of parts can be confined precisely to joint area. That is, of course, a factor in the low cost and high speed of operation but, in addition, there is very little oxidation, which means little or no cleaning of parts. Also, there is minimum annealing, a very important factor when high strength is a major consideration. Distortion which sometimes develops with other methods of heating can be reduced or entirely eliminated by induction heating.

OPA Increases Prices of Machine Tools

OPA has increased ceiling prices by 20 per cent on all machine tools not included in machinery and equipment specifically exempted from price controls April 8. Manually operated machine tools which are not portable are included in the increase.



THEW-LORAIN *Experience* PLUS TUTHILL Quality

EXPERIENCE counts! In this Thew-Lorain Moto-Crane unit is combined the experience of the Thew Shovel Co., builder of the Crane, and that of the Tuthill Spring Co. whose Springs are used. The wide, heavy-duty alloy TUTHILL Steel Springs used on the front axle are set far enough apart to provide a wide stable base to eliminate side roll. Auxiliary boosters absorb operating shocks. Leaf springs are better—and best when TUTHILL!

Tuthill makes Leaf Springs in standard and special types. Submit your Springs problems to our Engineers.



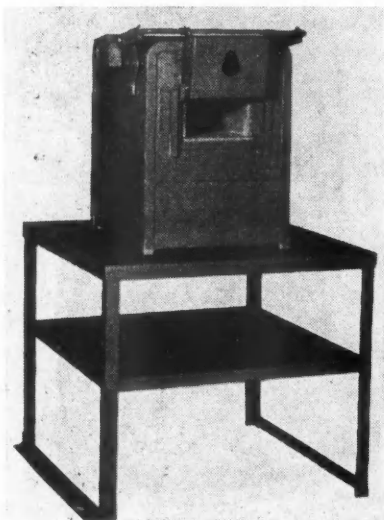
**TUTHILL
SPRING CO.**
760 W. Polk St.
CHICAGO 7, ILL.

Quality Leaf Springs for Sixty Years

New Production and Plant Equipment

(Continued from page 43)

Electric Mfg. Corp., Indianapolis, Ind. The standard furnace is manufactured with a hinged door which, when opened, forms a loading shelf. It is now offered in an alternate design incorporating a counter-weighted, vertically-operated door for particular use where only partial door opening to the furnace is required.



Cooley electric furnace with vertically-operated door and structural steel stand

Cooley electric furnaces have been supplied for industrial uses such as heat treating tools, dies and small parts, also for laboratory testing. They are manufactured in two standard sizes, the MH-3 with chamber dimensions of 8 in. wide by 6 in. high by 14 in. long, and the MH-4 with dimensions of 10 in. wide by 6 in. high by 18 in. long, for continuous operation at 1750 F. or intermittent operation at 1850 F.

The second new feature is a heavy gage structural steel stand of welded construction which is now being offered. It serves as a bench for the furnace, providing a shelf for storage space beneath the table top area. This stand establishes the furnace at the proper working height with the furnace hearth 42 in. above the floor.

A GAS cracking unit that is supplied with a catalyst and used in conjunction with heat treating furnaces to provide a protective, inert atmosphere that is effective in temperatures upwards of 2450 deg F, is offered by Bellevue Industrial Furnace Co., Detroit 7, Mich.

Atmosphere generating equipment consists of a gas cracker unit with all necessary controls such as pyrometers, flosopes, fire traps, automatic valves, etc. A motor-driven Selas machine supplies any air-gas ratio desired. Natural fuel gas at 100 Btu per cu ft is

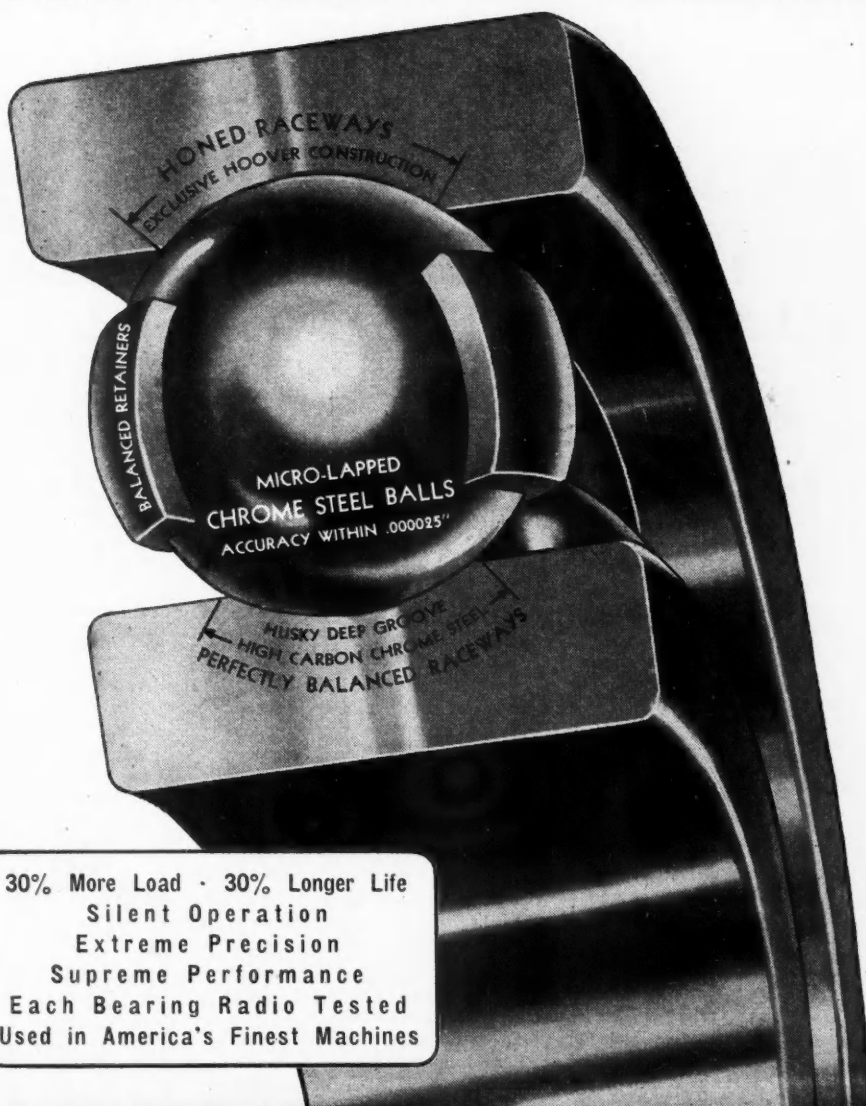
employed, although manufactured gas also can be used. It is mixed with a certain amount of air as determined by the setting of the Selas mixing machine and fed into the cracking unit. This consists of a high nickel alloy steel retort (SAE 3515) which is heated externally by a small furnace built around it. Retort is operated at a normal temperature of about 1830 deg F. In the retort are a quantity of high-temperature porous refractory cubes

which have previously been impregnated with a special catalyst.

When the operating temperature of 1830 deg F has been reached, the gas and air valves are opened and the Selas machine adjusted to supply the air-gas mixture desired. The heat of the retort assures complete combustion of the mixture and the catalyst in the retort effects the reaction which produces the controlled atmosphere. Before feed-

(Turn to page 86, please)

So much more...for so little more. AMERICA'S SUPER FINE BALL BEARING

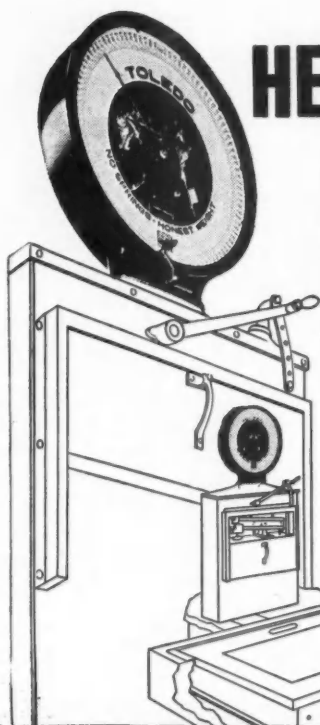


30% More Load · 30% Longer Life
Silent Operation
Extreme Precision
Supreme Performance
Each Bearing Radio Tested
Used in America's Finest Machines

HOOVER

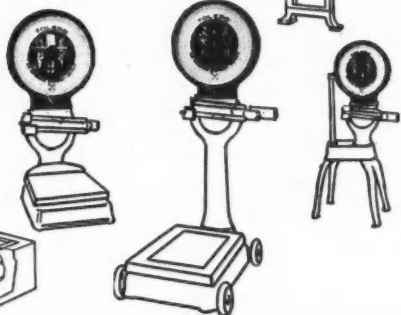
The Aristocrat of Bearings

HOOVER BALL AND BEARING COMPANY, ANN ARBOR, MICHIGAN



HEAD OF A FAMOUS FAMILY

Distinctive, the World over, is the head of a Toledo Scale. In factories, dairies, mines or mills—wherever seen it means—*Accurate Weight*. For inside the Toledo head is that ingenious Toledo full-floating, double-pendulum device which balances weight against weight to give accurate weighings with split-second speed. Toledo Scale Company, Toledo, Ohio.



TOLEDO

HEADQUARTERS FOR SCALES



Since 1903

Strand Flexible Shaft Machines have answered the call for portable, rotary power with efficiently designed, solidly constructed flexible shaft machines that insure constant speeds with dependability and greater operator convenience.

If your job calls for grinding, polishing, buffing, sanding, drilling, reaming, screw-driving or nut-setting—especially in out-of-the-way places, a Strand machine will do it faster, better, and stand up to it longer. Hundreds of attachments can be easily interchanged. 125 types and sizes. Models include vertical and horizontal type machines from $\frac{1}{8}$ to 3 H.P. Distributors in all principal cities.

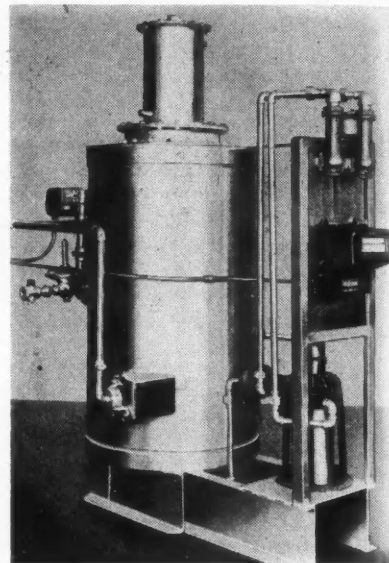
Send today for 112 page catalog showing complete line.



Type M5



N. A. STRAND & CO.
5002 NO. WOLCOTT AVE. CHICAGO 40, ILL.



Bellevue gas cracking unit

ing this into the furnace muffle, it is passed through a short cooling tower to lower the temperature to approximately 250-300 deg F. This is done to facilitate safe handling through the connecting pipe to the furnace, since it is not necessary to cool the atmosphere to remove water, as the dew point of the water vapor is so low it has no visible effect.

THE DoALL Co., 1301 Washington Ave. South, Minneapolis, Minn., has added another high-speed, metal-cutting band saw, the Zephyr 16, to its line. Designed primarily for light gage steel and foundry application, the Zephyr 16 is also applicable to woodworking and pattern shops, as well as on production lines where it is desired to cut material as fast as it can be fed into the saw.

This smaller version of the DoALL Company's Zephyr 36 has a 16 in. throat depth and a 10 in. thickness ca-
(Turn to page 88, please)



Zephyr 16 metal-cutting band saw

HOLTITE "TAP" Screws

The NEW
screw that actually **TAPS**
its own perfect mating threads



U.S. Pat. No. 2,292,195
Other Patents Pending



Cutting edges of slot perform
actual tapping operation

This slot, corresponding
to the flutes of a tap,
provides two balanced
cutting edges and a
reservoir for easier chip
clearance.

Where other self-tapping screws forcibly displace the material by a cold forging action, this remarkable new screw (fundamentally a narrow fluted two-flute tap) actually cuts its own perfect mating threads in any material to effect tighter, stronger, more enduring fastenings. In action, the curled chips cut from material are pushed ahead of the screw in same manner as chips are pushed ahead of a spiral pointed tap. Metal and non-metallic cuttings free themselves readily, thus eliminating binding, and reducing driving torque and effort.

Ideal for plastics and cast iron, these "TAP" Screws eliminate need for tapping any material, and can be used in holes much deeper than their own diameter. The pilot point permits "TAP" Screw to start straight in hole to prevent breakage.

Save Tapping Costs When Fastening Any Kind Of Material

CONTINENTAL SCREW CO.

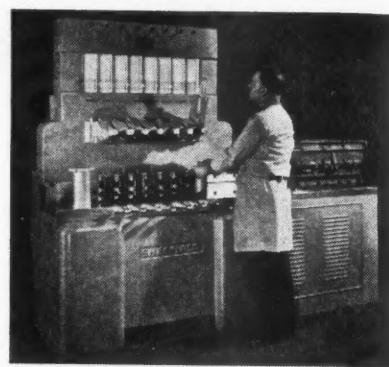
New Bedford, Mass., U.S.A.

capacity. The machine has an infinitely variable speed range from 1000 to 5000 fpm.

The combination of controlled saw speed and the special DoALL saw blade make fast cutting rates possible in sheet steel, aluminum, and ferrous and non-ferrous castings as well as paper, wood, plastics, laminates, and composition materials. Steel springs and links, flexible steel tubing, laminated rubber and steel, or aluminum and wood, combinations of steel and copper, steel and rubber tubing or porcelain steel can all be sawed on the Zephyr 16 with speed and good finish, according to the manufacturer.

The table of the Zephyr 16 is of the tilting type, and there is a disc cutting attachment for making circles, a rip fence, and a mitering attachment for cutting of regular and compound angles.

A MEASURING instrument of extreme precision for simultaneously gaging bore diameters of an automobile cylinder block at 32 points for "go" and "not go" and proper classification has been built by the Sheffield Corporation, Dayton, Ohio, for a large automobile manufacturer. This device weighs several thousand lb and is about four ft wide, eight ft long and seven ft in



Precisionaire measuring instrument

height, yet it uses the flow of air to accurately measure to 0.0001 in.

Designed expressly as an integral part of a production line, the Sheffield multiple spindle Precisionaire checks for diameter, taper and out-of-roundness of eight cylinder bores of an automobile engine block at four different points in each cylinder, and classifies them to .0003 in.

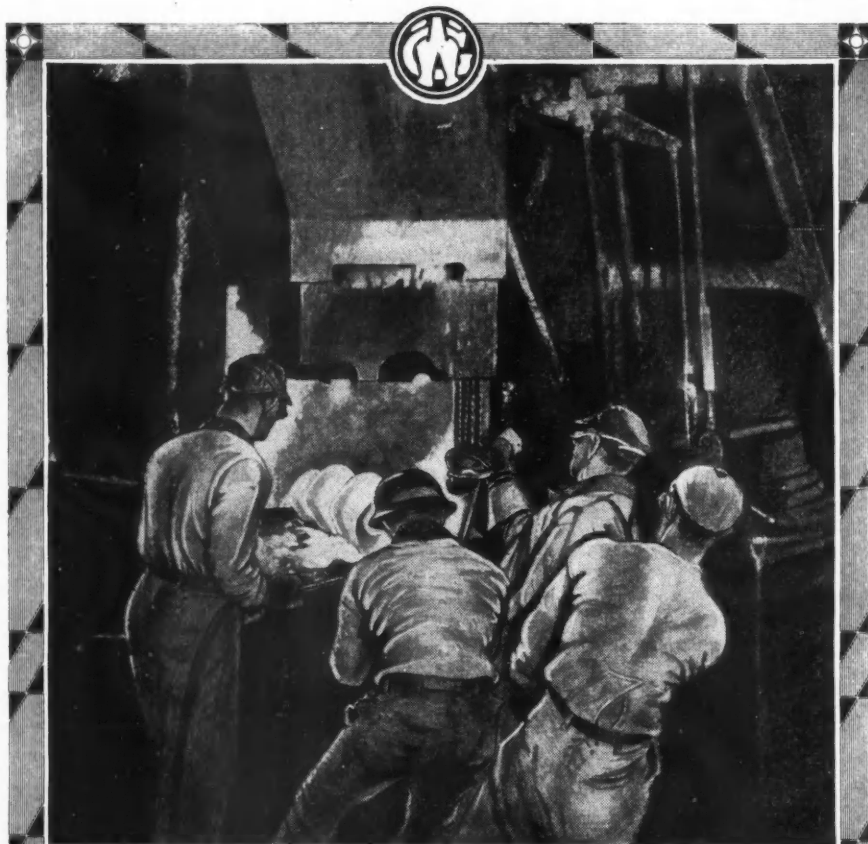
The engine blocks are brought to the gage by the conveyor line, then checked, and passed down the line to the next operation. The cycle begins with one block in loading position. As the starting button is depressed, loading arms pick up the block and advance it to the gaging position where two hydraulic plungers locate the block and hold it in place. As an additional precaution, a shot bolt enters the locating hole in the top of the block and insures proper location.

Now perfectly aligned, the eight cylinder bores are entered by eight spindle assemblies which elevate automatically. Each assembly consists of four spindles that float independently to allow for tolerances in hole spacing. Upon reaching the limit of travel, the spindle automatically stops and can be manually rotated through 180 deg for out-of-round inspection. The spindles may be stopped at any point and rotated 180 deg, if so desired. In the event interference is encountered by any one of the sets of spindles, the machine will stop and a red light indicates the incorrect cylinder bore.

Thirty-two Precisionaire indicating tubes are grouped and located at eye level. Each of the eight spindle assemblies has four Precisionaire tubes to indicate its findings. A scale graduated in .0003 in. and marked off in selection sizes of numbers from 1 to 10 is located to the right of the right hand tube in each set.

As the engine block is being gaged, the floats instantaneously fall in the tubes to a position opposite a number on the scale. The movable tolerance slide is positioned to determine if all four floats are within the out-of-round and taper limits which are .0007 in. If so, the selection size is indicated by the number opposite the float in the right hand tube. This number is then manually stamped on the engine block

(Turn to page 92, please)



WITH the close of the war—the facilities of Wyman-Gordon, Worcester plant—the largest aircraft forging producer in the country . . . became available for industry in general.

New forging techniques, particularly in light alloys, frequently make possible the use of forgings for applications heretofore considered impossible.

Perhaps forging methods can be worked out to give your product the benefit of the superior qualities of forgings.

WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel

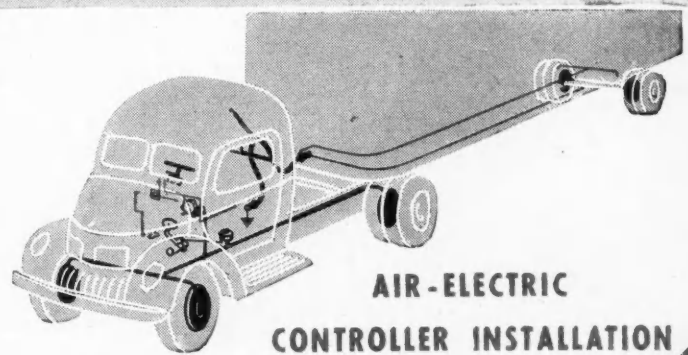
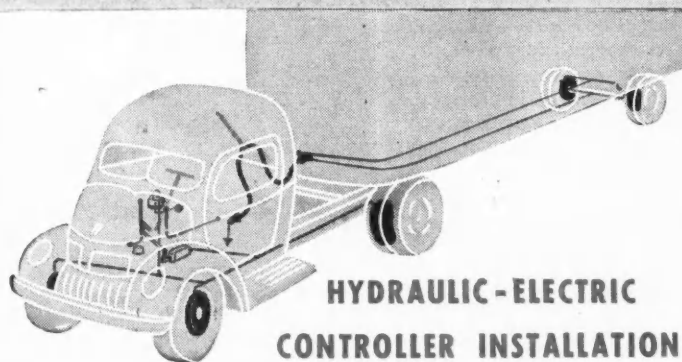
WORCESTER, MASSACHUSETTS, U. S. A.

HARVEY, ILLINOIS

DETROIT, MICHIGAN

BRAKE ACHIEVEMENT...

**Synchronizes Either Type of Tractor Brakes
with Trailer Electric Brakes
so Foot Pedal Operates ALL Brakes Together**



*Controller is easily and quickly fitted
into tractor's hydraulic brake line.*

*For tractors with air brakes, the Con-
troller installation can be made with
equal speed and ease.*

**FOOT PEDAL PRESSURE
CONTROLS BRAKES ON
Both TRACTOR AND
TRAILER**



WARNER
ELECTRIC BRAKES

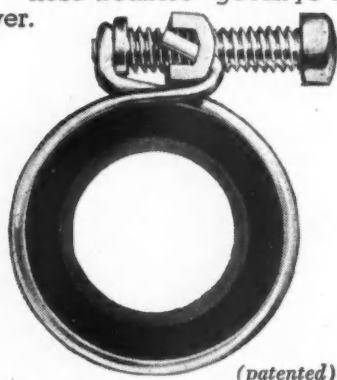


it's not magic

... the way the new Central "360" Wire Clamp Hose keeps its vise-like grip on any type of hose. It's made to "hold-on" to the last mile on the speedometer. Clamps completely around the hose ... can't be loosened at any point of contact by jolt or vibration.



Manufacturers, mechanics and owners can now kiss their "leaky-hose-troubles" goodbye forever.



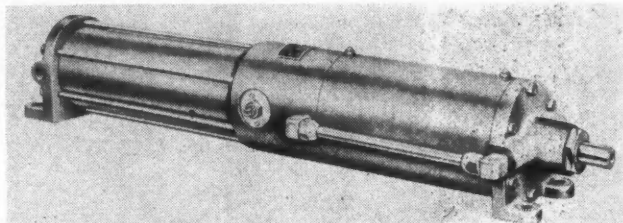
(patented)

Before being offered to the trade, the Central "360" Wire Hose Clamp was subjected to every conceivable test ... for every possible application. RESULT ... it's unconditionally guaranteed. Costs no more. Worth much more.



CENTRAL "360"
WIRE HOSE CLAMP
CENTRAL EQUIPMENT CO.
900 S. Wabash Avenue, Chicago 5, Ill.

Air-Draulic cylinder



directly beside the cylinder bore so classified. Stamping of the selection size of each bore is accomplished by a marking device mounted directly above each of the eight spindle assemblies. After all cylinder bores have been stamped, the spindle assemblies are retracted and the machine is ready to begin a new cycle.

MEAD SPECIALTIES COMPANY, 4120 North Knox Avenue, Chicago 41, Ill., has placed on the market a new air-operated column press. This unit, which delivers a ram pressure of 3000 lb on 110 lb line pressure, is said to be particularly useful for small to medium runs where it is desirable to leave fixtures permanently mounted to base.

With the column press, successive operations may be performed by swinging the ram over desired fixture, raising or lowering it to the correct height by means of the raising screw, and locking it in place with the two drawbolts. In some cases a dozen or more small fixtures may be left permanently set up, ready for immediate use when needed. In general, it is desirable that the fixtures be "self-sufficient," requiring only the pressure of the plain ram to complete the operation. This eliminates the need for attaching dies, punches, and other tools to the ram for each new operation.

LOGANSPOUT MACHINE Co., Logansport Ind., is making a line of air power units with hydraulic-type control and built-in adjustable speed-control

valve. Named "Air-Draulic," they are made with separate air and hydraulic pistons assembled as an integral unit on a common piston rod.

Five standard mounting types are offered—foot, clevis, center-line, rod-end flange and blind-end flange. Combination mountings with one of these types at the blind end of the cylinder and another type at the rod end can also be furnished.

Air-Draulic cylinders are available in 4 standard sizes from 3 in. to 8 in. bore, with any length of stroke to 5 ft. The air piston is built for operation at pressures to 150 psi.

Machine Tool Standards

(Continued from page 48)

through the usage of their products. Since the war, machines have been received, the motors for which have been removed from the cubby hole in the base of the tool and mounted on a bracket attached to the back of the column; this is a good practice. A machine was seen on the receiving dock the other day with moisture proof flexible conduit running to a movable head that was a very good looking job. Of course, all builders cannot change their entire line overnight or maybe not in a year. However, it is hoped that a machine tool builder will not use these difficulties as an excuse to prolong the changes required.

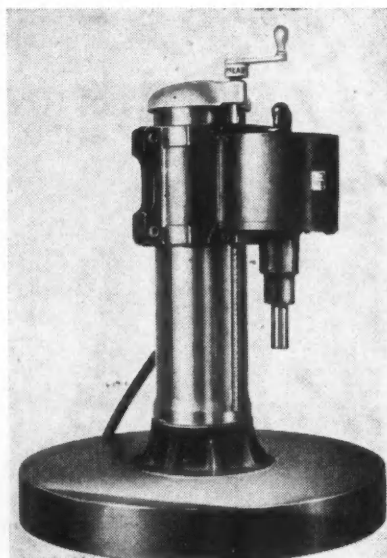
Lloyd W. Dunn to Head New Agency

Lloyd W. Dunn, vice president of Rickard and Co., Inc., left for Los Angeles, Cal., on April 15 to form and head a new advertising agency, with which Rickard and Co. will be affiliated. This new agency will represent Rickard and Co. on the West Coast.

Classified Advertisements

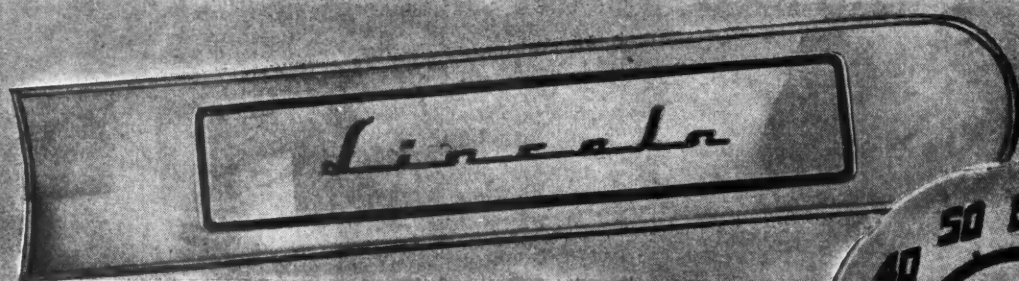
PACIFIC COAST REPRESENTATION — AGGRESSIVE ORGANIZATION WILL ACT AS MANUFACTURER'S REPRESENTATIVES IN ACCORDANCE WITH YOUR SALES POLICY. JOBBERS, RESIDENT BUYERS, MANUFACTURERS, AND DEALER DIRECT. CONTACT WEST SALES COMPANY, 1521 2ND AVENUE, LOS ANGELES 6.

WANTED: Small or medium factory to locate in Granby, Missouri. Wonderful opportunity, good labor connections and housing conditions. For information write Charles L. Burtrum, Box 111, Granby, Mo.



Mead air-operated column press

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES



Many of these

Dials of Distinction

(HORN-BUTTONS, MEDALLIONS, LENSES TOO!)

on the **FORD**, the **MERCURY**,
the **LINCOLN** are made of

DU PONT

"LUCITE"

THERE ARE almost as many reasons for the wide and growing use of acrylic resin on the new cars as there are applications of this sparkling, transparent plastic. It's natural that the alert design engineers of The Ford Motor Company have been quick to utilize these advantages—with the results shown on this page.

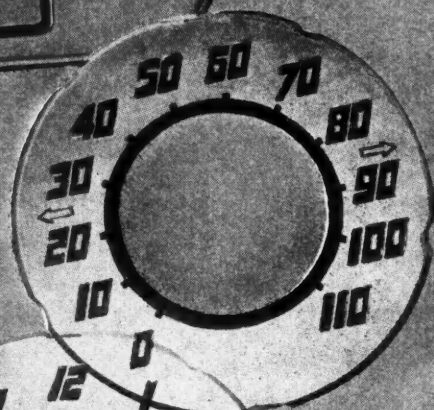
The beauty of "Lucite" acrylic resin is apparent at a glance. It has other qualities not so obvious which make that beauty last. For "Lucite" has remarkable resistance to sunlight and weathering. "Lucite" has good shatter-resistance, good tensile and flexural strength. Of especial value on the dashboard of the modern automobile is the remarkable ability of "Lucite" to "edge-light."

Taken together, these properties add the distinction that makes any car more salable. The ease of molding "Lucite" gives high economy of production, too. Available in your choice of colors as well as in colorless transparent.

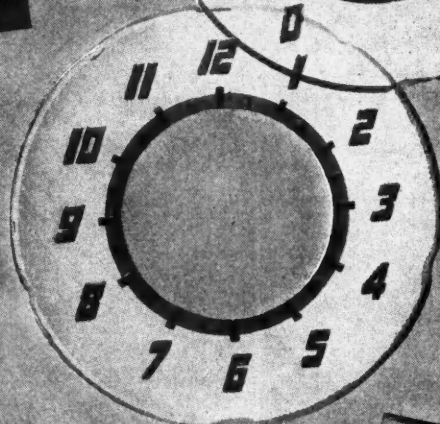
Write for booklet *Heat-Resistant "Lucite."*
Address E. I. du Pont de Nemours & Co.
(Inc.), Plastics Dept., Room 205, Arlington,
N. J.

Glove compartment
medallion
1946 Lincoln

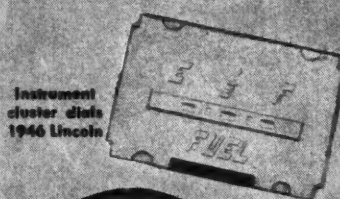
Speedometer
dial
1946 Lincoln



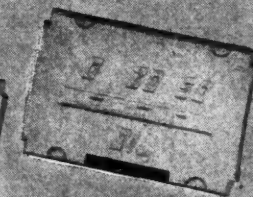
Clock dial
1946 Lincoln



Instrument
cluster dials
1946 Lincoln



Horn button
1946 Ford



Horn button
1946 Lincoln



Horn button
1946 Mercury

These parts molded
by Hoosier-Cardinal
Corp., Evansville,
Indiana, Erie Resistor
Co., Erie, Pa. and
Plastic Molders, Inc.,
Chicago, Ill.

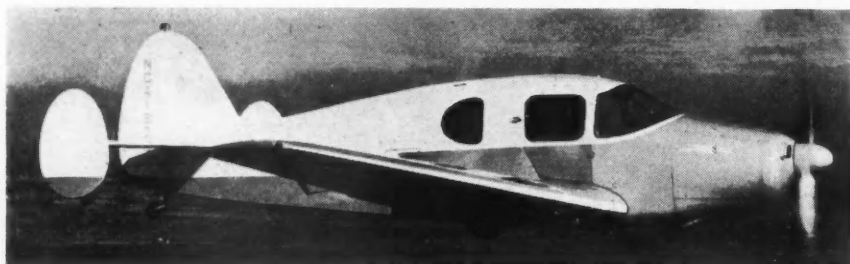
DU PONT

REG. U. S. PAT. OFF.

Plastics

BETTER THINGS FOR BETTER LIVING
THROUGH CHEMISTRY

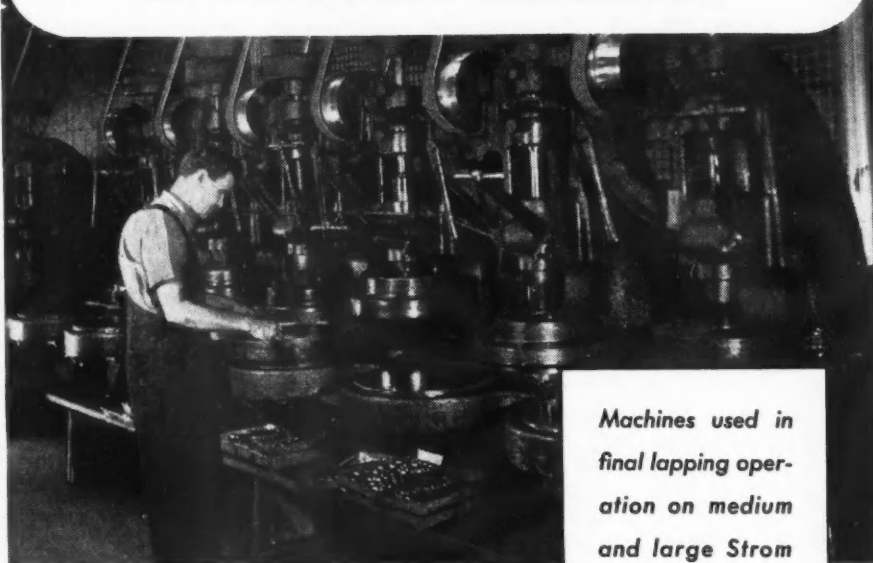
Bellanca Cruisair Senior



This four-passenger, low-wing monoplane has a cruising speed of 150 mph with its 150-hp engine. It is equipped with a fully-retractable landing gear. Interior appointments are said to be equal to those of a quality automobile. The Cruisair Senior is built by Bellanca Aircraft Corp., New Castle 2, Del.

Surface • Sphericity • Precision

STROM BALLS



Machines used in final lapping operation on medium and large Strom Balls.

It takes a long series of processes, developed and perfected over a period of years, to make a thing as faultless in material and form as a Strom Metal Ball. Worked to a tolerance of fifty millionths of an inch, their outstanding qualities of finish, sphericity and precision have made Strom Balls the standard of industry. Strom Steel Ball Co., 1850 South 54th Ave., Cicero 50, Illinois.

Strom BALLS  **Serve Industry**

Largest Independent and Exclusive Metal Ball Manufacturer

ASTE Elects Officers

A. M. Sargent, Pioneer Engineering Co., Detroit, was elected president of the American Society of Tool Engineers at the annual meeting of the Board of Directors of the Technical Society, succeeding C. V. Briner of Pipe Machinery Co. of Cleveland.

Mr. Sargent is succeeded as first vice-president by W. B. Peirce, vice-president, Flannery Nut and Bolt Co., St. Louis, Mo., and formerly second vice-president of the American Society of Tool Engineers.

Elected second vice-president was T. P. Orchard, General Manager, American Tool Engineering Co., New York, N. Y.

Irwin F. Holland, General Superintendent, Small Tool and Gage Department, Pratt & Whitney Division, Niles-Bement-Pond Co., Hartford, Conn., and formerly chairman of the Society's Constitution and By-Laws Committee was named third vice-president.

R. B. Douglas, Works Manager, Propeller Division Canadian Car and Foundry Company, Ltd., Montreal, Quebec, and regional Director from Eastern Canada, was named national secretary of the Society.

V. H. Ericson, Vice-President Johnson de Vou, Inc., Boston, Mass., was elected treasurer, with W. Dawson, F. F. Barber Machinery Co., Ltd., re-elected as assistant secretary-treasurer.

Harry E. Conrad was re-elected executive secretary of the Society.

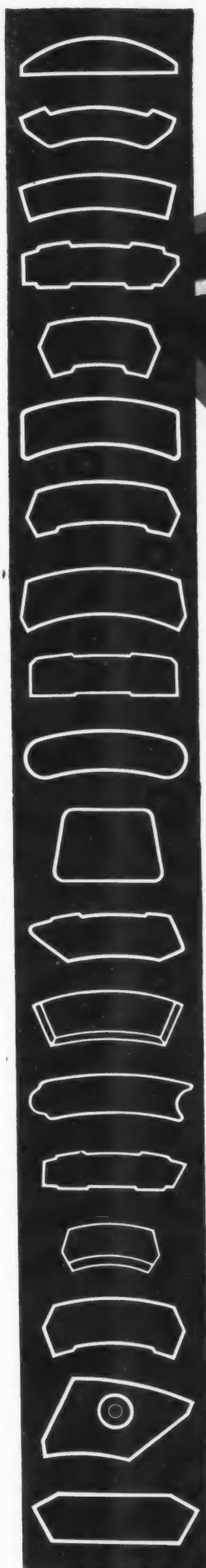
ASTM Moves to New Address in Philadelphia

The American Society for Testing Materials which for a number of years has had its headquarters at 260 S. Broad St., Philadelphia 2, Pa., is moving to its permanent headquarters building at 1916 Race St., Philadelphia 3, Pa. This building, which was purchased and remodeled through contributions made by many of the companies and individuals active in the Society's work, will provide much needed additional space that is required by the expansion of the Society's staff.

Prices Set for Ford and Mercury Sportsman's Coupes

Ceiling prices for two additional 1946 model passenger automobiles—one a Ford Super de Luxe Eight Sportsman's convertible coupe and the other a Mercury Sportsman's convertible coupe—have been announced by the Office of Price Administration.

These prices, which do not include excise taxes, transportation or preparation and handling charges, are as follows: Ford Super de Luxe Eight Sportsman's convertible coupe, \$1558; Mercury Sportsman's convertible coupe, \$1764.



SIMONDS ABRASIVE SEGMENTS *for every chuck*

Regardless of the type of segmental chuck on your grinder, you need not pass up the extra values and economies which are yours through the use of Simonds Abrasive Segments. Fabricated to fit every standard chuck, Simonds Borolon (aluminum oxide) and Electrodon* (silicon carbide) segments in all shapes and sizes give superior long lasting performance to produce the best results on your surface grinding operations. Available in every required grain size with Vitrified, Resinoid, Silicate or Shellac Bonds for solid or gap type segmental wheels. For diversified and specialized needs you can count on Simonds Abrasive Segments to demonstrate maximum production efficiency for you.

* Time-honored Borolon and Electrodon Abrasive Products are now distinguished by the name Simonds.

SIMONDS ABRASIVE CO. is a
Division of



Other affiliated companies:



The same exacting standard of quality which has distinguished Simonds Abrasive products for more than a half century governs the manufacture of Simonds Abrasive Segments.

You will find Simonds Abrasive distributors, located in all principal cities, helpful in recommending the Segments to meet your requirements.



SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. DISTRIBUTORS IN ALL PRINCIPAL CITIES

Scintilla Self-Contained Setup

(Continued from page 33)

Micromatic Hydrohoner for honing the bearing seats in magneto housings.

Several setups in this department are worthy of special attention. Take the large magneto housing as an example. The large volume during the war made it possible to develop a high speed method for boring a number of stepped diameters and facing in the same machine. For this purpose they have tooled a double-end Heald 46-B Bore-Matic having two spindles at one end and a single spindle serving simply as

an arbor at the other end. The housing is held in a fixture or "shuttle" as they term it for boring and facing the open end. One spindle takes the roughing cuts, the other finishes, the work being moved from one station to the other. Then the housing is removed from the shuttle and located on the arbor at the other end. Tool slides arranged on the work table then do the boring and facing.

Another type of large housing is finished in a three-way Ex-Cell-Oo pre-

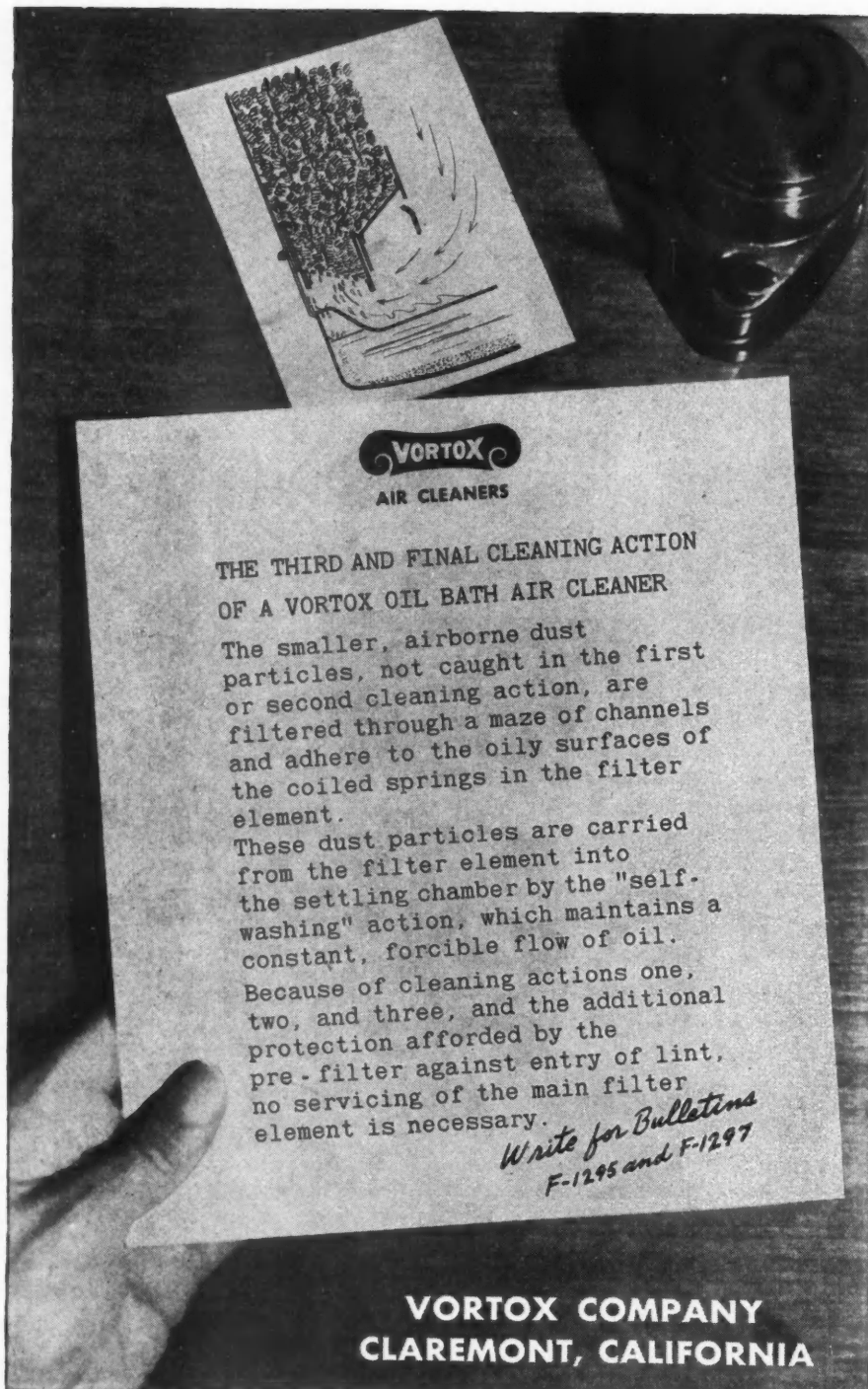
cision boring machine. Here again, rough- and finish-boring is done in two operations on two machines. One of the side spindles takes the boring of two stepped diameters and two bearing seats, as well as facing; the other spindle does the recessing and boring of another bearing seat. The center spindle bores three stepped diameters.

It also is interesting to find as a standard procedure the slotting of fastening holes in the flanges done in one-way Ex-Cell-O precision boring machines fitted with two, three, or four spaced spindles depending upon the number of slots required. In this operation the work is held in a fixture, fed into the cutting tools, then indexed radially to produce the slot.

The next major department is devoted to the manufacture of a variety of Diesel fuel injection pumps, unit injectors, nozzle holders, nozzles, and spray tips. They are produced in many plunger sizes ranging from approximately $\frac{3}{8}$ in. diameter to 1 in. diameter in relatively small quantities calling for extremely flexible production. This department is serviced by a separate lathe department immediately adjacent to it. Parts received from automatics, screw machines and the lathe department pass through several lines of drill presses ranging from multi-spindle Deltas for relatively light work to 4-spindle Leland-Giffords. Separate drilling lines are maintained for housings, nozzle holder bodies and small parts and are interspersed with tapping machines so that parts can be completed in a continuous flow before they reach the grinding section. One of the most interesting drilling operations is the drilling of long holes in nozzle holders. These holes are $\frac{1}{8}$ in. diameter drilled approximately 10 in. deep with a maximum run-out of 0.015 in. and are performed on a hydraulically operated Leland-Gifford step drill. Drilling operations are usually followed by milling which is handled on Kearney & Trecker, Sundstrand automatics, Nichols hand millers and thread hobbing machines. Another operation is the milling of the metering helix in fuel pump plungers for which special fixtures are used which duplicate the helix lead with great accuracy. Location of the helix is measured on specially designed optical gage equipment.

Adjacent to the milling section, we find the grinding department using Cincinnati and Brown & Sharpe cylindrical grinders, Arter, Brown & Sharpe, Cincinnati, and Norton surface grinders and special Heald internal grinders for the grinding of fuel pump cylinders and nozzles. An accuracy of 0.0001 in. is maintained in finish grinding plungers and nozzle parts, all measuring being done by Sheffield internal and external position gages. Another interesting operation is the internal grinding of nozzle bodies where the guide hole for the nozzle needle and the seat for the needle are finish ground in

(Turn to page 100, please)



VORTEX
AIR CLEANERS

THE THIRD AND FINAL CLEANING ACTION
OF A VORTEX OIL BATH AIR CLEANER

The smaller, airborne dust particles, not caught in the first or second cleaning action, are filtered through a maze of channels and adhere to the oily surfaces of the coiled springs in the filter element.

These dust particles are carried from the filter element into the settling chamber by the "self-washing" action, which maintains a constant, forcible flow of oil.

Because of cleaning actions one, two, and three, and the additional protection afforded by the pre-filter against entry of lint, no servicing of the main filter element is necessary.

*Write for Bulletins
F-1295 and F-1297*

**VORTEX COMPANY
CLAREMONT, CALIFORNIA**

Federal

AUTOMATIC WELDING

It is significant that metal fabricating industries noted for producing the most goods at lowest unit cost are the largest users of automatic resistance welding... also that Federal welders fill the "lion's share" of such applications.

Nowhere are production costs more critically scrutinized than in the automotive industry—which uses and continues to order more Federal Resistance Welders than any other group. One reason is the sort of production illustrated at left. Two full-door-size stampings are welded into permanent union in a single pass through one of the latest machines developed by Federal in collaboration with designers of the door itself. Refrigeration, radio and instrument makers follow this lead for the same reason—that fabricating costs are cut by Federal.



**GET THIS
BULLETIN**
describing all of the
basic types of Federal
Resistance Welders.

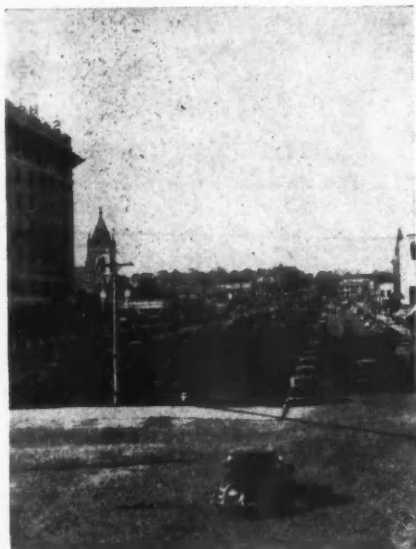
Not all of these applications call for special machines. There is a wide variety of basic types in the Federal welder line. Infinite variations of each are available with simple adaptations. Whatever YOU make in metal, it makes sense for you to study the practical reasons why the big timers, and others as well, turn more and more to *fabrication with Federal Resistance Welding*. It pays to do this before your product design is completed.

Get a copy of Federal Bulletin SP 346, which briefly describes each of the basic welder types. Then let a Federal Engineer prove to you that the best production welding is by

Federal

AND WELDER COMPANY

220 DANA STREET • WARREN, OHIO



Down In the City of Pensacola, Fla.

In Pensacola, Florida you will find many modern Layne Well Water Systems. Check the city water works, big paper pulp mills, the Naval Air Station and auxiliary fields, Army Training Camp, the largest brewery, the ice plant, a wood chemical processing plant and other industries. All have highly efficient Layne Well Water Systems. The same record of Layne installations applies to hundreds of other cities. The reason is more than obvious. Layne Well Water Systems are better designed, more efficient, sturdier built and of finer quality materials.

Layne Well Water Systems serve hundreds of cities, factories, railroads, mines and irrigation projects in all parts of the world—and consistently show the lowest upkeep cost of any well water producing equipment made.

The services of Layne Engineers, who are widely experienced in all phases of water production are available without cost or obligation. For further details, literature, etc., address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves hundreds of dollars on power cost per year.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.



**WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS**

(Continued from page 96)

one operation. Production of nozzle parts requires particular care and is, therefore, handled in a special line arranged to completely finish nozzle bodies, the blanks for which are received from automatics. In order to maintain close quality control, many inspection operations are carried out on the machines and a complete inspection department is immediately adjacent to manufacturing lines.

Lapping operations are performed in a separate enclosed department to eliminate possibilities of damage from grinding dust and dirt. These operations are carried out on Norton lapping machines for plungers and nozzle needles, Ultra lapping machines for flat lapping, and Micromatic and Sunnen honing machines for finishing internal bores. Fitting benches are arranged in close proximity to the lapping machines. Continuously cooled and filtered cleaning fluid is supplied to each bench from a central system comprising a large cooling and filtering unit. Here again, inspection is arranged immediately adjacent manufacturing. Assembly of pumps and nozzle holders also is done in this section, finished units being delivered to the inspection department. Drilling of spray orifices is carried out in this section using special high speed drilling machines capable of producing spray orifices of 0.008 in. diameter and larger.

The test room is completely separate

from manufacturing to provide a maximum of cleanliness and to exclude noise.

To provide complete self-sufficiency the plant also contains facilities for the production of coils, windings, and condensers for all requirements. This department has modern automatic multiple winding machines for coils for the flywheel type magneto which is made in large quantities; and single winding machines for aircraft coils.

Except for the long narrow department along one side of the building which houses the heat treating department and process operations, to be mentioned later, we have now reached the central section of the plant where the assembly departments are concentrated. One large area is devoted to the bench assembly of aircraft magnetos and this communicates directly with the final test room for magnetos and wiring harness. Adjoining the aircraft magneto assembly is the harness assembly which produces two types of harness at this writing. One type is housed in a magnesium casting; the other is of tubular type mounting seven magnetos for a 28-cylinder engine.

At the extreme rear of the main building are self-contained departments for industrial magneto assembly and for assembly of the flywheel type magneto. The latter is the only high-production assembly setup at the present writing. It is entirely self-contained

(Turn to page 104, please)

Be
100%
With
10%
Buy
Bonds

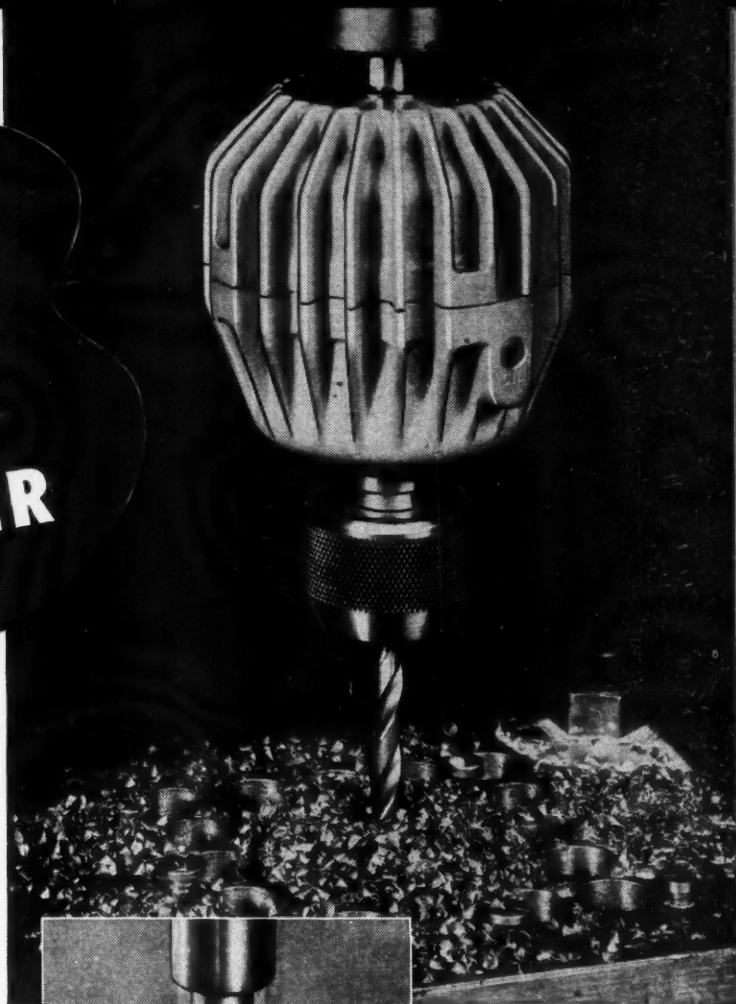


More Speed... LONGER DRILL LIFE WITH CONTINENTAL'S *New* DRILL CHIP BREAKER

• Faster drilling action and prolonged tool life are but two of many advantages obtained with the Continental Drill Chip Breaker. By breaking chips into small, uniform pieces that are easily carried up the flutes of the drill, clogging is eliminated. The unit can be used vertically, horizontally, or at any angle as long as the housing can be kept stationary while the drill rotates. The arm prevents rotation of the housing. Where space permits, the Continental Drill Chip Breaker can be used in multiple spindle heads. Write for Continental Bulletin 28161 today for sizes and complete specifications.

YOU PROFIT 7 WAYS WITH CONTINENTAL'S DRILL CHIP BREAKER

- 1 • **GREATER SPEED**—Because there is no clogging, it is not necessary to withdraw the drill to clear chips from the hole.
- 2 • **PROLONGED TOOL LIFE**—The free cutting action results in more holes being drilled before sharpening is necessary.
- 3 • **BETTER FINISH ON HOLES**—Holes are round, straight, and smooth. The short chips travel up the drill flutes without scratching or clogging.
- 4 • **DEEPER HOLES**—It is possible to drill holes many diameters deeper, eliminating the necessity of withdrawing the drill from hole to relieve chips.
- 5 • **AUTOMATIC FEED**—Automatic feed can be used without the danger of drill breakage that so often results from chip-clogged holes.
- 6 • **GREATER SAFETY**—There are no long, whirling, spiral chips to burn hands or cut fingers.
- 7 • **CLEANER OPERATION**—Coolant penetrates easily to the very point of the drill; the short chips do not splash it on machine or operator.



Above: With the Continental Drill Chip Breaker, the chip is broken at regular intervals. Small loose chips are easily carried up the flutes. Holes are straighter, rounder, and have better wall finish.

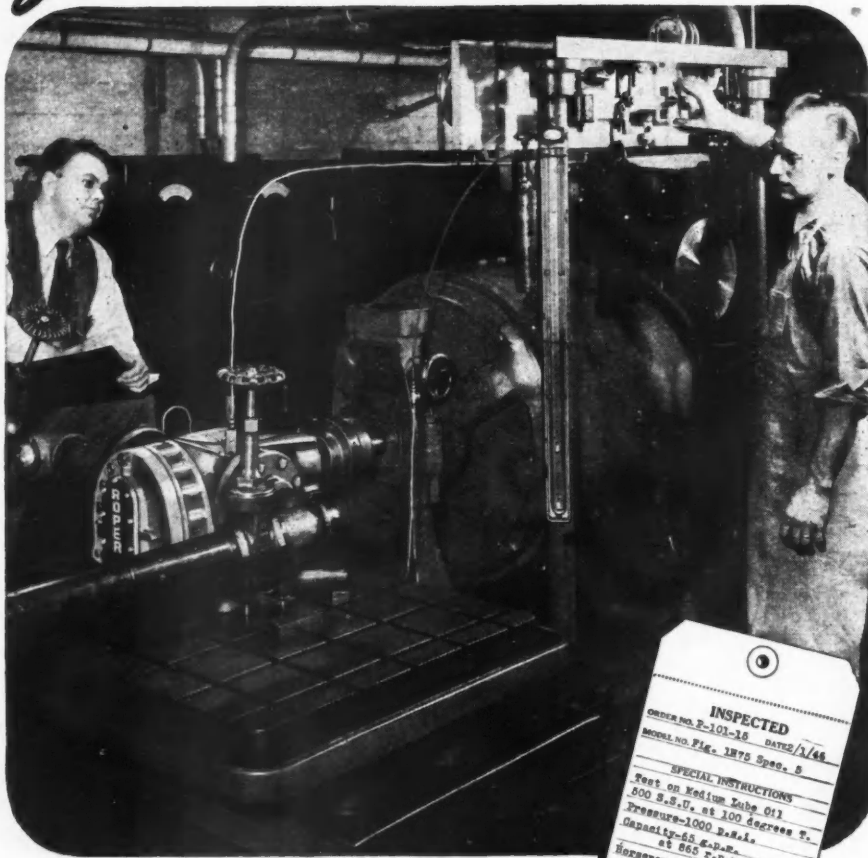


Left: With conventional drilling, solid chips pack the drill flutes, causing scratched, out-of-round, and crooked holes. The drill must be withdrawn repeatedly to clear flutes and avoid drill breakage.



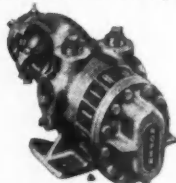
CONTINENTAL TOOL WORKS
DIVISION OF EX-CELL-O CORPORATION
1200 OAKMAN BOULEVARD • DETROIT 6, MICHIGAN

Your "TEST TICKET"



PUMP PROVING GROUND WORKS FOR YOU AT ROPER

Here on a dynamometer test block, a Roper 75 g. p. m. pump is put through its paces. With modern test facilities its performance is accurately measured, and results are predetermined. It is a painstaking procedure that is followed out at Roper to prove each pump. Yes, prior to shipment, each Roper is given a rigid, individual horsepower and capacity test. And the test standards set up to meet requirements are recorded on the "test-ticket" which you receive with each pump. It's your insurance against faulty performance and costly time losses. For standard as well as for special engineered units, the proving ground works for you at Roper.



Other Roper Features that Insure Dependable Service

Continuous bearing lubrication . . . Axial hydraulic balance . . . Floating equal size external gears . . . Oversize bearings, gears supported at both ends . . . Efficient operation in either direction . . . Can be serviced without disturbing pipe connections, power unit or pump mounting . . . Packed box or mechanical seal units to suit customer's needs . . . Wide range of sizes to handle pressures up to 1000 lbs. p.s.i. capacities $\frac{1}{4}$ to 300 g.p.m. at speeds up to 1800 r.p.m.

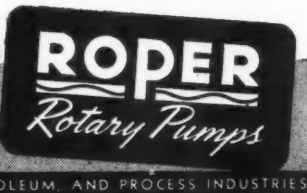
SEND FOR BOOKLET "HOW TO SOLVE PUMPING PROBLEMS"
A valuable guide on the selection, operation and maintenance of pumps. Filled with factual, time-saving information.

GEO. D. ROPER CORPORATION
603 Blackhawk Park Ave., Rockford, Ill.

PUMPS ESPECIALLY ENGINEERED TO FIT YOUR REQUIREMENTS



BUILDERS OF PUMPS FOR MANUFACTURING MARINE PETROLEUM, AND PROCESS INDUSTRIES



(Continued from page 100)

even to making laminations and the machining of the housing. Here will be found a mechanized final assembly line served by benches for small sub-assemblies. The main line starts with several presses producing laminations for the pole shoes, machining of the housing, assembly of laminations to the housing, riveting of pole shoes. This is followed by the various assembly stations at which each operator completes a part of the job. Near the end of the line is the station for magnetizing the Alnico permanent magnets used in this unit. The complete magneto is inspected and shipped from this department.

Finished magnetos are put through a severe test schedule on the run-in stands and on the inspection machines. Final inspection in sound-proof booths checks each machine for the following characteristics:

1. secondary voltage
2. bearing and gear noise
3. "coming-in speed" — minimum speed at which all gaps are firing regularly
4. short circuiting

Sampling of Routings

At this point we shall introduce a group of three factory routings showing the methods used in the machining of a large aircraft magneto housing of magnesium, a breaker cam, and a magneto rotor.

Magneto Housing (Magnesium) Routing

OPERATION AND EQUIPMENT

Cut off pole shoes — Cincinnati vertical miller.

Mill 2 coil seats, snap gage 5.312 \pm 0.005 contour gage—Sundstrand miller No. 1.

Boring and facing: Pos. 1—Rough bore, chamfer inside of pilot, rough bore 4.125 diam, rough bore & face 3.250 diam, chamfer, rough bore 2.562 diam, rough bore 2.530 diam, rough bore 2.0625 diam, bore 2.344 diam; Pos. 2—Finish bore, finish bore 4.125 diam, bore and face 3.250 diam, semi-bore pilot to 2.5303-2.5323, semi-bore 2.530 diam to 2.500-2.504, finish bore 2.0625 diam, bore B.B. seat; Pos. 3—Turn flange end and face, face and undercut, bore pilot, chamfer ID, turn pilot, face, chamfer OD, face.—No. 46 Heald Bore-Matic.

Drill 1 locating and 2 pin holes—Delta 1-spindle drill press.

Finish mill inside of pole shoes: Pos. 1—Mill inside of pole shoes, first side; Pos. 2—Mill inside of pole shoes, other side. Width gage 1.998-2.000.—No. 0 Sundstrand miller.

Mill abress between pole shoes—Pratt & Whitney proffler.

Mill clearance inside coverseat — Nichols hand miller.

Degrease—Detrex degreaser.

Shrink in bushing—No. 3 Greenard arbor press, Kold-Hold freezing unit.

Check press fit of bushing—Hannefin air press.

Drill 38 holes: Pos. 1—Drill cover and pole holes; Pos. 2—Drill 4 mounting holes and 8 holes 10-32—2-14 spindle Natco drill presses.

Drill 8 fastening holes and 8 holes in rotor bore: Pos. 1—Drill 4 fastening holes and 4 holes 10-32; Pos. 2—Repeat Pos. 1—14-spindle Natco drill.

Countersink and burr all holes—Delta 2-spindle drill press.

(Turn to page 106, please)

FELT



...**"ACES"** as bridge table covering



...**"KING"** of materials for protecting **PRECISION-MADE MACHINE PARTS**

VERSATILE Felt helps you "play your cards better"—both in bridge and in superior machine production.

Between each operation, precision-made parts, which must be handled "with care", are placed on pads of sheet Felt. This prevents damage from scratching, jarring or banging, and makes it easier for the next operator to pick up the part.

In Sealing, Felt protects millions of ball bearings from dirt, grit and moisture, and prevents the leakage of lubricants.

American Felt Company product engineers are available to discuss the latest techniques of Felt as a protective or sealing agent — or to advise on any other Felt application. Write for samples and Data Sheet No. 9, "Sheet Felts, Standard Grades and Specifications".

American Felt Company Data Sheets are listed below. Check and write for those which you need to complete your Felt reference file.

- | | |
|--|--|
| 1. Felt Density and Hardness | 9. Sheet Felts, Standard Grades and Specifications |
| 3. "K" Felt—Sound Absorption and Thermal Insulation | 10. Vibration Isolation with Felt |
| 5. S.A.E. Specifications—American Felt Company Qualities | 11. Felt Seals, Their Design and Application |
| 7. A.S.T.M. Methods of Test for Wool Felt, D 461 | 12. Flame-proofed Felt |
| 8. U.S. Army Spec. No. 8-15G | 13. Felt in Compression |
| | 14. Vistex — Packings — Gaskets — Seals |



General Offices: GLENVILLE, CONN.

New York; Boston; Chicago; Detroit; Philadelphia; Cleveland; St. Louis
Dallas; Los Angeles; Seattle; San Francisco; Portland

(Continued from page 104)

Mill 1 boss 30 deg—Morey profiler.
Slot abress in rotor bore—P & W No. 7 vertical shaper.

Countersink and tap 6 holes: Pos. 1—Redrill and counterbore 30 deg bo-s; Pos. 2—Drill 4 holes in outlet and 2 name plate holes; Pos. 3—Countersink; Pos. 4—Tap 6 holes—Haskins tapper and Delta 3-spindle drill press.

Profile back side of flange—Pratt & Whitney profiler.

Redrill, counterbore and spotface 2 bosses 20 deg—Edlund drill press.

Drill 2 holes in outlet bosses, counterbore 4 holes, 0.375 diam and insert plugs and stake, tap 2 holes: Pos. 1—Drill 2 holes 0.046 diam; Pos. 2—Counterbore 4 holes, insert plugs and stake; Pos. 3—tap 2 holes 1-20 NEF-3—Haskins tapper and Delta 3-spindle drill press.

Drill 2 name plate and 2 holes: Pos. 1—Drill 2 holes 0.0625 diam; Pos. 2—Drill, ream 1/8-27 holes and countersink; Pos. 3—Tap—Haskins tapper and Delta 2-spindle drill press.

Drill, countersink and tap 2 holes 1/8-27 NPT on 20 deg angle: Pos. 1—Drill 2 holes; Pos. 2—Ream and countersink; Pos. 3—Tap—Delta 3-spindle drill press.

Drill 2 holes in bushing seat—Delta 1-spindle drill press.

Tap 8 holes flange end and 8 holes breaker end; Tap 8 holes inside rotor bore; Tap 22 cover fastening and 4 pole shoe holes both sides—Haskins 2-spindle tapper.

Stamp timing marks—Greenerd arbor press.

Finish face flange, finish turn pilot, finish bore 1.874 diam, face bottom of bushing—No. 49 Heald Bore-Matic.

Finish grind bushing 1.8502 diam—Heald Sizematic grinder.

Finish bore rotor bore and pilot 2.5625 diam—Heald Bore-Matic.

Final burr and file radius, wash and clean threads, inspection before painting.

Painting and cleaning—Paint Shop.

Insert 8 bushings, drill 8 pin holes, insert pins and lock, retap 8 bushings—Delta 4-spindle drill press.

Final inspection.

Rotor Assembly Routing

OPERATION AND EQUIPMENT

Assemble 1 end plate to shaft; assemble rotor—Pos. 1, assemble location plate and 4-pole piece assembly; Pos. 2, assemble magnet ring and locating plate; Pos. 3, assemble 4-pole piece assembly and end plate—Fox press.

Assemble nut and tighten to 0.100 ± 0 pounds per foot.

Drill two locking pin holes—Delta 1-spindle drill press.

Insert and lock 2 pins, insert 8 taper pins. Rivet 8 rivets—Vibrator and Townsend riveter.

Turn lamination, hold OD to 3.015 ± 0.002 in.—Fay automatic lathe.

Finish face drive end and break edge on nut and counterbore 0.266 hole—Warner & Swasey turret lathe No. 3.

Finish face three shoulders—Warner & Swasey No. 3 automatic.

Semi-grind diam, grind 0.781 diam, rough grind 0.8135 diam, rough grind 0.6689 diam, rough grind 0.4999 diam, rough grind 0.4345 diam, finish grind 0.8135 diam, final inspection for 0.8135 diam, finish grind 0.4345 diam—Cincinnati grinder.

Assemble retainer bushing—Fox press (gear).

Hob spline 36 teeth, hob spline 24 teeth—No. 3 Barber-Colman hobbing machine.

Rough grind lamination, finish grind lamination, rough grind 1.019 diam, finish grind 1.019 diam, finish grind 0.7869 diam, finish grind 0.781 diam, finish grind 0.6683 diam, finish grind 0.4999 diam, finish grind thread diam—Cincinnati grinder.

Drill cotter pin hole and countersink both ends of hole—Delta 1-spindle drill press.

Rough and finish tap 1/8-28—Bakewell tapping machine.

Grind thread—Jones & Lamson thread grinder.

Break sharp edges and chamfer cam end, cut off thread end, and break all sharp edges, drive end—South Bend 18-in. engine lathe.

Burr and hand wire brush spline, final inspection.

Breaker Cam Routing

OPERATION AND EQUIPMENT

Finish face to length, finish turn shoulder, chamfer and rough ream taper—Warner & Swasey No. 3 turret lathe.

Finish bore taper—Heald Bore-Matic No. 48A.

Stamp part number—Noble & Westbrook No. 4.

Broach keyway—American vertical broaching machine.

Rough mill contour. Note: Check relation of lobes to keyway and hold to 1 deg. Check on Helco light gage—Sundstrand No. 00 cam miller.

Spot timing mark—Delta 1-spindle drill press.

Rough mill timing flat—Sundstrand No. 00 automatic miller.

Burr, wash, inspection, pack harden per spec., pickle.

Steel blast, use 70 lb pressure—Pangborn S. B. machine.

Rockwell test inspection.

Grind to length, grind to high limit +0.001-0.000 in.—Norton surface grinder.

Finish grind taper hole—Heald sizematic No. 81.

Finish grind taper hole and base—Bryant internal grinder.

Grind bevel—Cincinnati grinder.

Finish grind timing flat—Norton surface grinder.

Finish grind contour. Note: Check concentricity of lobes and valley depths using arbor, bench centers and dial indicator—Heald sizematic No. 81.

Final burring, wash, final inspection.



That
**UNMISTAKABLE
LOOK OF
Champions**

MAKERS of
THRUST BALL BEARINGS,
Standard and Special
ANGULAR CONTACT
BALL BEARINGS
ROLLER BEARINGS
Special,
BALL RETAINERS,
HARDENED and
GROUND WASHERS

Aetna  **BALL & ROLLER
BEARINGS**

Aetna manufactures many types of ball and roller bearings. And a wise step, with any bearing problem, is to talk it over with Aetna Engineers. Aetna Ball and Roller Bearing Company, 4600 Schubert Avenue, Chicago 39, Illinois.
In Detroit: SAM T. KELLER, 7300 Woodward Avenue, Phone Madison 8840-1-2